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FINAL CONTAMINATION ASSESSEMENT PLAN HEALTH AND SAFETY PLAN PLUME  
DELINEATION DEFENSE FUEL SUPPLY POINT (DFSP) CNC CHARLESTON SC  
03/01/1992  
NAVFAC SOUTHERN

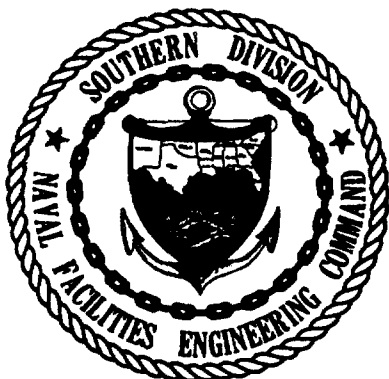
# FINAL



## CONTAMINATION ASSESSMENT PLAN HEALTH AND SAFETY PLAN

PLUME DELINEATION  
DEFENSE SUPPLY POINT  
HANAHAAN, SOUTH CAROLINA

MARCH 1992



SOUTHERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
CHARLESTON, SOUTH CAROLINA  
29411-0068

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NOTIFICATION OF THE COMMANDING OFFICER OF  
THE DEFENSE FUEL SUPPLY POINT, HANAHAAN, SOUTH CAROLINA



**CONTAMINATION ASSESSMENT PLAN**

**PLUME DELINEATION  
DEFENSE FUEL SUPPLY POINT  
HANAHA, SOUTH CAROLINA**

**CTO NO.: 00010**

**CONTRACT NO. N62467-89-D-0317**

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**March 1992**

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ACRONYMS, INITIALISMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services, Inc.
BETX	benzene, ethyl benzene, toluene, xylenes
bls	below land surface
CA	Contamination Assessment
CAP	Contamination Assessment Plan
CARS	Contamination Assessment Reports
cm/sec	centimeters per second
DFSP	Defense Fuel Supply Point
EIC	Engineer-in-Charge
FID	flame ionization detector
ft/day	feet per day
ft <sup>2</sup> /day	square feet per day
GC	gas chromatograph
gpm	gallons per minute
MOPs	Monitoring Only Proposals
msl	mean sea level
NOFAPs	No Further Action Proposals
OVA	organic vapor analyzer
PRAPs	Preliminary Remedial Action Plans
PVC	polyvinyl chloride
SCDHEC	South Carolina Department of Health and Environmental Control
SOUTHNAV-	
FACENGCOM	Naval Facilities Engineering Command, Southern Division
USAEHA	U.S. Army Environmental Hygiene Agency
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey

## 1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES), was contracted by the Naval Facilities Engineering Command, South Division (SOUTHNAVFACENGCOM) to prepare a Contamination Assessment Plan (CAP) for the Defense Fuel Supply Point (DFSP), Hanahan, South Carolina. The purpose of the CAP is to outline a field investigation and sampling program that will assess the source and extent of petroleum contamination along the eastern and western boundaries of the site. The investigation and subsequent report will be presented by SOUTHNAVFACENGCOM to the South Carolina Department of Health and Environmental Control (SCDHEC) for review. The following report presents the site location, summarizes previous investigations, and develops the rationale for the proposed monitoring plan to be implemented under the Contamination Assessment (CA).



## 2.0 BACKGROUND

2.1 SITE DESCRIPTION. The DFSP site is located approximately 3.5 miles east of Charleston Air Force Base within the city limits of Hanahan, South Carolina (Figure 1). The site occupies approximately 36 acres just east of North Rhett Avenue. Immediately north of the DFSP facility is a residential community called Gold Cup Springs Subdivision (Figure 2). The areas to the west and south of the site are comprised mainly of light industry. Immediately east of the site is a U.S. Army-Navy Reservation. The facility contains seven, 70,000-barrel capacity, aboveground storage tanks, truck loading stands, and several buildings. Each tank is constructed of welded steel with a floating roof and is surrounded by an earthen berm. The primary product handled at the facility is JP-4 jet turbine fuel.

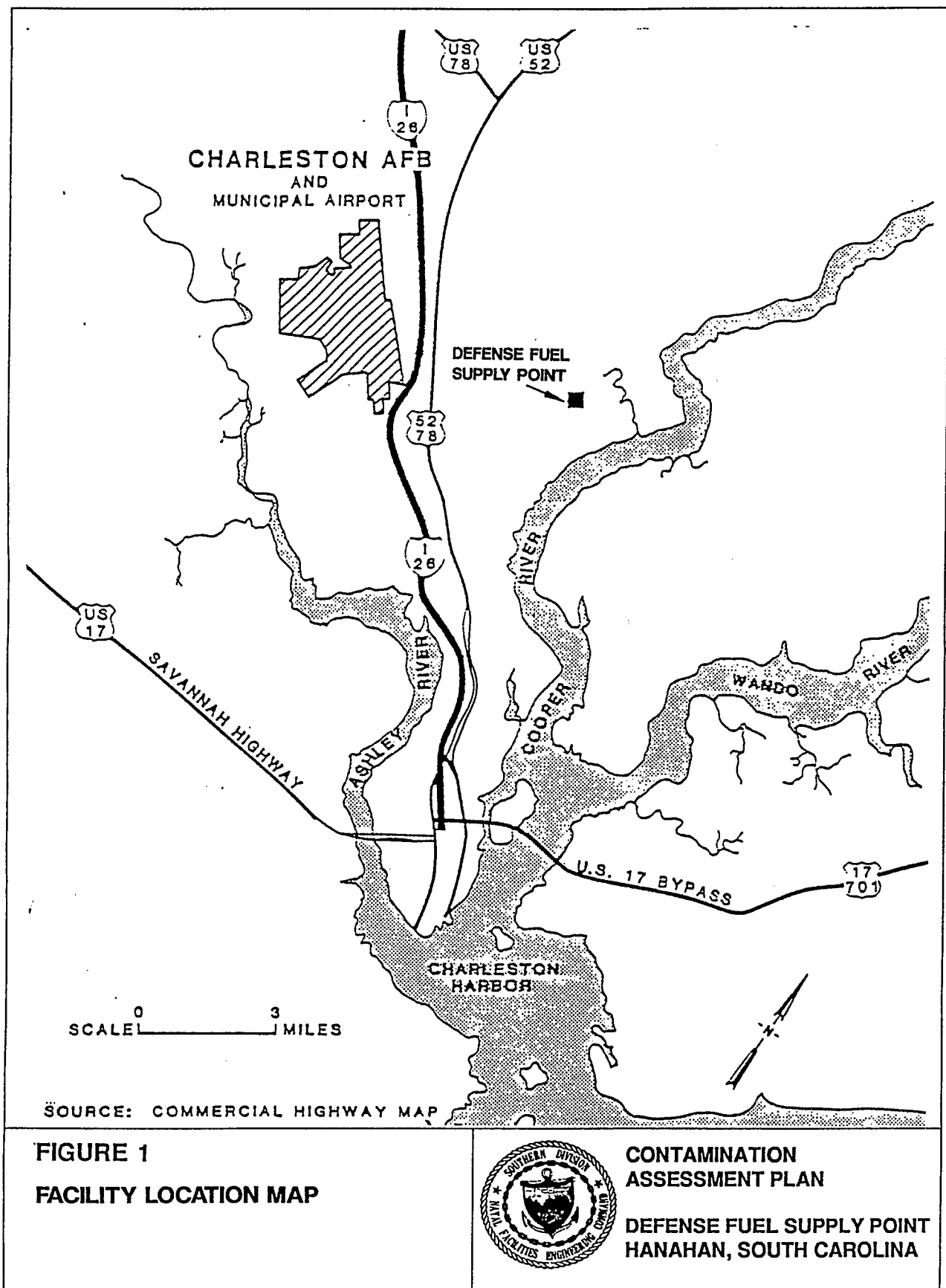
The DFSP facility is owned and operated by the Defense Logistics Agency, Alexandria, Virginia, and the facility property is owned by the U.S. Air Force. Environmental investigations and remedial activities at the site are being performed by SOUTHNAVFACENGCOM.

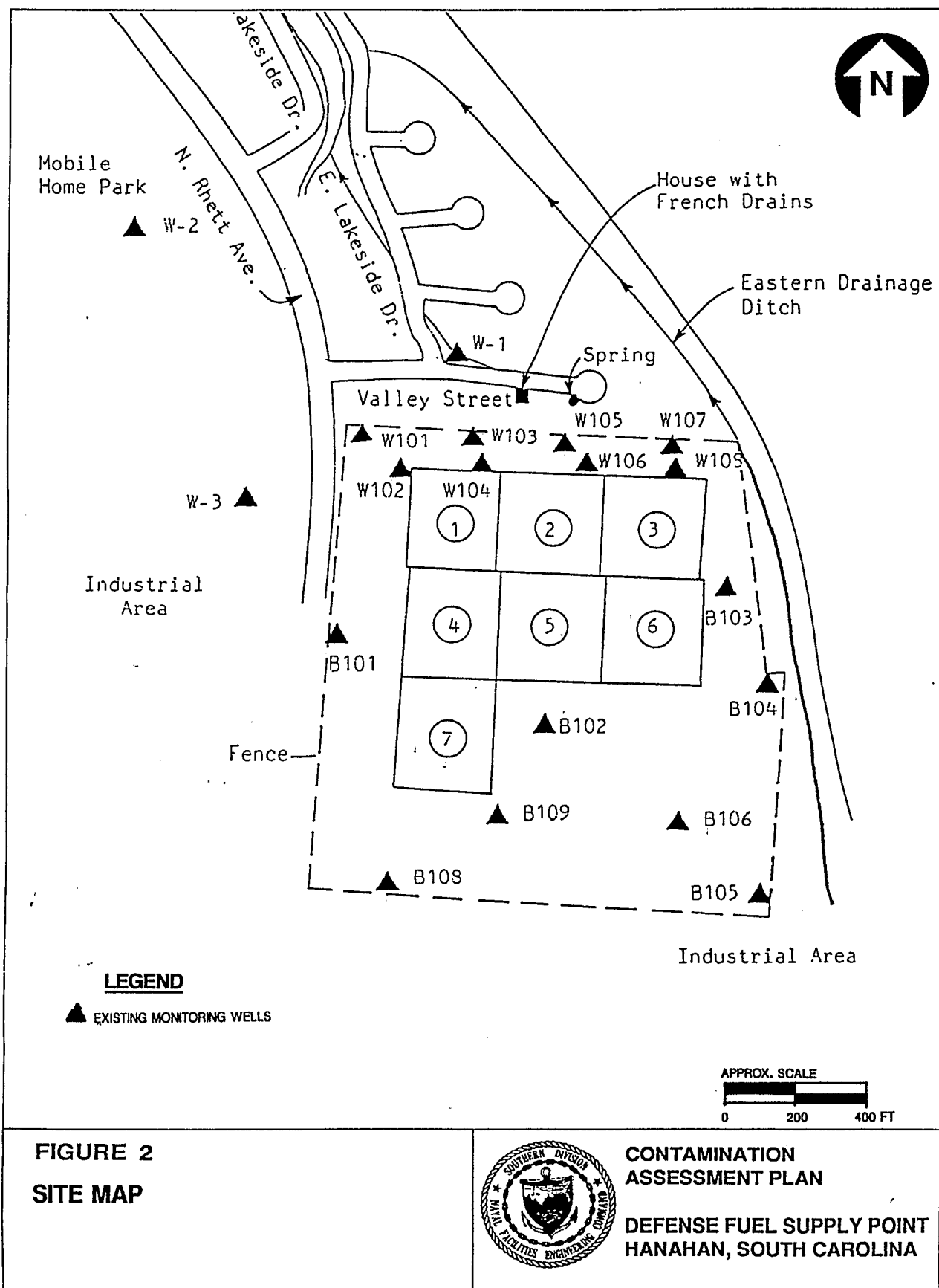
2.2 SITE HISTORY. In September 1975, a leak developed in the bottom of storage tank No. 1 immediately after it had been cleaned and put back in service. Approximately 83,000 gallons of JP-4 jet fuel were lost before a water bottom was put in the tank. Leakage was confirmed to be the cause of the loss. The lost fuel reached the shallow, surficial aquifer and migrated northward into the Gold Cup Springs Subdivision, a subdivision of approximately 75 homes.

In November 1975, the U.S. Army Environmental Hygiene Agency (USAEHA) from Aberdeen Proving Ground, Maryland, was brought in to investigate the site. Monitoring wells were installed to delineate the contamination and a well point system was constructed in December 1975 to extract the fuel from the groundwater and soils. The well point system became impractical by January 1976. A collection ditch was built along the northern border of the site to collect the remaining fuel. A second well point system was installed in March 1976 and was operated until April 1976. It was estimated that approximately 25 percent of the lost fuel was recovered by these operations.

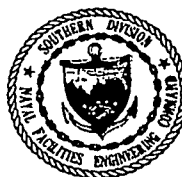
In June 1980, the Defense Fuel Support Center (DFSC) contracted Dames and Moore to conduct a field investigation and monitoring program to assess the extent of groundwater contamination at the DFSP facility and in the Gold Cup Springs Subdivision, north of the facility. Dames and Moore installed 17 monitoring wells and collected groundwater samples from these wells for pH, specific conductance, total organic carbon, oil and grease, and diethylene glycol monomethyl ether (a fuel system icing inhibitor) analyses. The study concluded that hydrocarbon-related contamination was present in minimal amounts and was dispersed around the site. Past fuel recovery, chemical and biological processes, and natural dilution had reduced groundwater contamination.

In 1985, samples from additional monitoring wells installed by Science Applications International Corporation and sampled by General Engineering Laboratories, revealed JP-4-related compounds, including benzene, ethyl benzene, toluene, and xylenes (BETX) in an off-site wells. In additional studies conducted by McClelland Engineers, Inc., in 1986 and RMT, Inc., in 1987, JP-4-





**FIGURE 2**  
**SITE MAP**



**CONTAMINATION  
ASSESSMENT PLAN**

**DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA**

related compounds were detected in the groundwater, surface water, soil, and sediment within the Gold Cup Springs Subdivision. In addition, air monitoring studies conducted by RMT, Inc., in 1987 identified some contamination of the air in subdivision homes and throughout the neighborhood.

In October 1987, ICF-Clements Associates, Inc., prepared a Risk Assessment for the DFSP facility. The results were that inhalation and ingestion of contamination associated with the facility, most notably benzene, could pose a potential cancer risk of greater than 1 in 1 million and that exposure to chemicals, while swimming in pools filled with contaminated groundwater, may result in significant risk. Exposure to noncarcinogens (most notably total xylenes) may also result in a hazard index greater than 1.

As a result of the investigations at the site, bioremediation was selected as the cleanup technique. The U.S. Geological Survey (USGS) is currently operating and monitoring the bioremediation system at the site.

In addition to the 83,000-gallon fuel leak at tank No. 1, other areas of the facility have been found to be contaminated with petroleum hydrocarbons. Small spills and leaks are the likely contributors of contamination in these areas. The USGS performed an initial site screening of the site using a passive soil gas survey in 1990. The USGS report (1991) concludes that an assessment of contamination delineation should be performed along the eastern and western parts of the facility.

## 2.3 HYDROGEOLOGY

2.3.1 Regional Hydrogeology The Charleston, South Carolina, area is underlain by four water bearing zones. These zones include the surficial water table aquifer, the Tertiary Aquifer System, the Black Creek Aquifer, and the Middendorf Aquifer.

The Coastal Plain of South Carolina, which includes Charleston, consists of a series of complex, interbedded unconsolidated to partially consolidated sedimentary formations of Late Cretaceous to Quaternary age. Surficial sediments within the study area consist of a variable sequence of sand, silt, and clay with a basal conglomeratic layer containing phosphate nodules that are a part of the Ladson Formation. The formation averages about 30 feet in thickness. These sediments were deposited as a result of a series of sea level encroachments and recessions that occurred during the Pleistocene epoch (Siple, 1946.)

The surficial water table aquifer is contained within the unconsolidated sediments of the Ladson Formation. The aquifer is recharged largely by the infiltration of precipitation over the area. Locally, the aquifer may be recharged by seepage from the underlying Santee Limestone in areas where the Cooper Formation is absent. Discharge from the surficial aquifer occurs principally by evapotranspiration and through natural seepage to surface water bodies. Shallow wells account for only a small amount of discharge from this aquifer and vertical migration into underlying aquifers is limited by the Cooper Formation. Depth to the water table of the surficial aquifer ranges from 3 to 15 feet below land surface (bls) and generally reflects changes in the local topography. Well yields average approximately 85 gallons per minute (gpm) with reported transmissivities between 600 and 1,340 feet squared per day (ft<sup>2</sup>/day)

(Park, 1985). The groundwater is commonly acidic and may contain high iron concentrations.

Unconformably underlying the Ladson Formation and forming the lower confining unit of the surficial aquifer and upper confining unit of the Tertiary Aquifer System is the Cooper Formation of Oligocene age. The Cooper Formation is a massive sandy, phosphatic limestone that is uniform in color and texture. The Cooper Formation requires only a few feet of thickness to effectively retard vertical groundwater flow.

Underlying the Cooper Formation and comprising the Tertiary Aquifer System are the Santee Limestone of Eocene age and the Black Mingo Formation of Paleocene age. The Santee Limestone consists of a creamy-white to gray, slightly glauconitic lime mudstone to marl. The unit ranges from 60 to 80 feet thick in the project area (Park, 1985). Wells tapping this unit yield between 200 and 500 gpm and are mostly under artesian conditions. The Tertiary Aquifer System is recharged by infiltration in updip outcrop zones inland of the project area. Groundwater flow in the aquifer is to the southeast under relatively flat regional hydraulic gradients (Aucott and Speiran, 1985). Excessive hardness and high iron and fluoride concentrations are common in the groundwater of the Santee Limestone. Brackish water can be found at the coastal margin of Charleston County.

The Black Mingo Formation underlies the Santee Limestone and is composed of limestone, green to gray argillaceous sand, and dark-gray to black clay. This formation is approximately 400 feet thick in the project area (Park, 1985). This formation is hydraulically connected to the Santee Limestone and is the lowest unit of the Tertiary Aquifer System. The sands of the Black Mingo Formation constitute the major water-bearing strata. Well yields average approximately 230 gpm. Transmissivities in this unit range from 500 to 3,700 square feet per day ( $\text{ft}^2/\text{day}$ ) and hydraulic conductivities range between 29 to 170  $\text{ft}/\text{day}$  (Park, 1985).

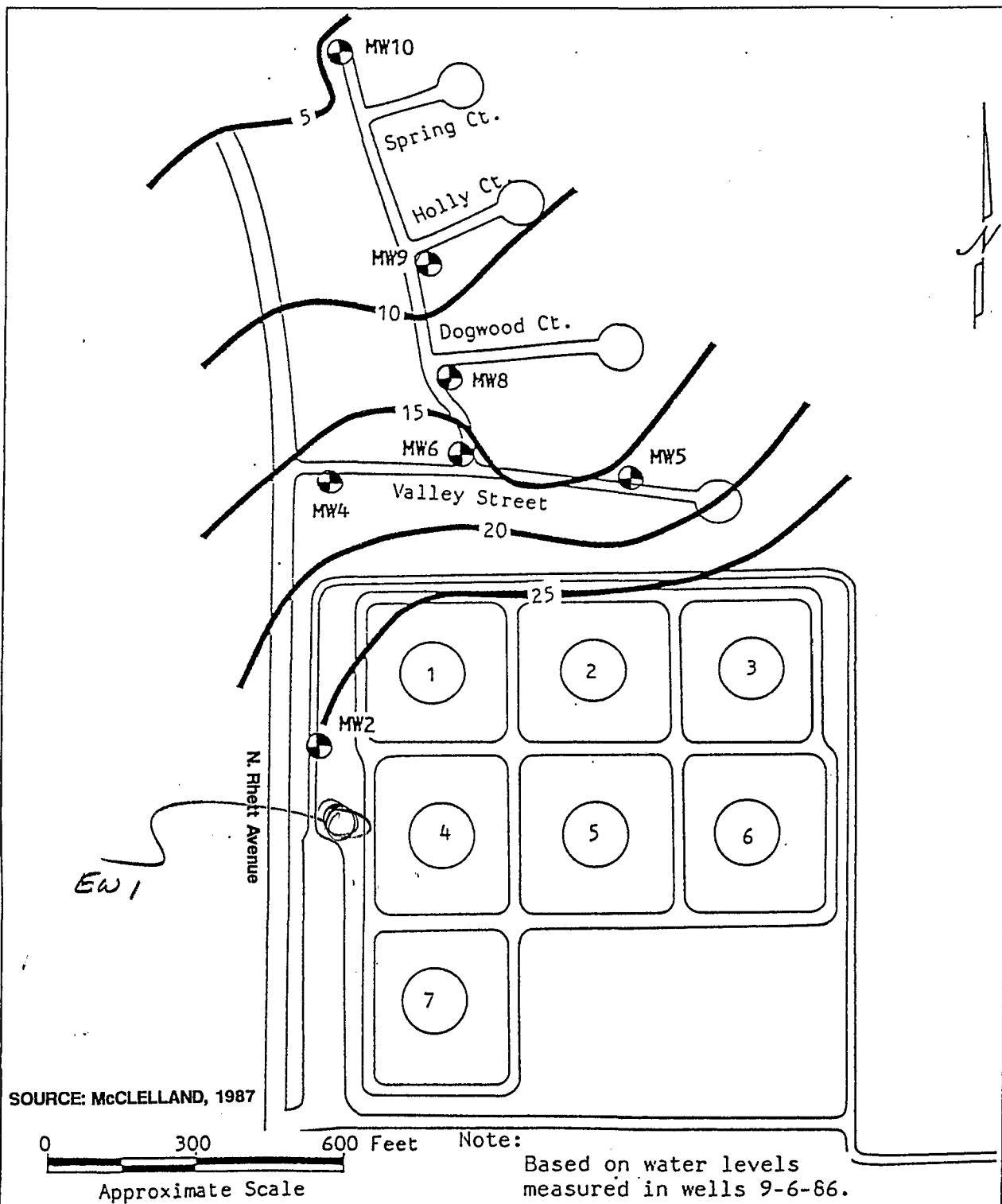
Underlying the Black Mingo Formation approximately 700 feet below mean sea level (msl) are the Peedee, Black Creek, and Middendorf Formations of Late Cretaceous age. These formations consist of interbedded sand, silt, and clay with occasional limestone. Each of these formations is capable of producing groundwater under artesian pressure; however, the major water bearing zones are the Black Creek Aquifer in the Black Creek Formation and the Middendorf Aquifer in the Middendorf Formation.

The lower part of the Black Mingo Formation and the Peedee Formation contains sufficient clays and silts to form an effective vertical hydraulic barrier between the upper Tertiary Aquifer System and the lower Black Creek Aquifer. Another confining unit exists in the lower Black Creek Formation and upper Middendorf Formation to separate the Black Creek Aquifer from the Middendorf Aquifer. Hydraulic conductivity in the Black Creek Aquifer has been estimated at 2 to 59  $\text{ft}/\text{day}$  with a storage coefficient of  $10^{-4}$  (Park, 1985). Groundwater flow direction in the Black Creek Aquifer is to the east. The Middendorf Aquifer is the most productive of the two aquifers with groundwater flow to the east-northeast under a gentle regional hydraulic gradient (Aucott and Speiran, 1985). Both aquifers contain potable water; however, in some areas water quality may have excessive concentrations of dissolved sodium, bicarbonate, and fluoride.

The basement rock in the region is Triassic in age and occurs approximately 3,000 feet below msl (Park, 1985).

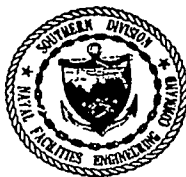
**2.3.2 Site Hydrogeology** Soil boring and monitoring well data from previous studies indicate that the DFSP site is underlain by 25 to 38 feet of recent fill and fine sands with numerous clay and silt lenses and basal layers of phosphatic gravels of the Ladson Formation. This formation thins towards the north. The surficial aquifer is contained in these materials. Beneath the Ladson Formation and forming the base of the surficial aquifer is the homogeneous, dark green-gray calcareous clay and silt (marl) of the Cooper Formation. This formation is estimated to be 260 feet thick in this area and presents a very competent confining layer in the site area (Dames and Moore, 1982). The contact between the Ladson and Cooper Formations is undulatory and varies between 1 and 8 feet above msl. Depth to the surficial aquifer water table ranged from 5 to 18 feet bls during previous investigations. Some of this variability is based on surface elevations; however, the data suggests that the water table fluctuated by as much as 7 feet at the site.

The general direction of groundwater flow in the surficial aquifer at the site is to the north-northwest. Localized groundwater flow directions at the site may be controlled by topography, with groundwater flow west of the DFSP site toward the west and groundwater flow just north of the DFSP site generally towards the centerline of the north-south valley through which East Lakeside Drive runs. Figure 3 illustrates a water table contour map from data collected on September 6, 1986. Calculations for hydraulic conductivity from monitoring wells at the site using the Hvorslev (1951) method range from  $10^{-4}$  to  $10^{-3}$  centimeters per second (cm/sec). An estimated seepage velocity at the DFSP site was calculated as  $8.5 \times 10^{-5}$  cm/sec or 0.24 ft/day using an average hydraulic conductivity of  $8.5 \times 10^{-4}$  cm/sec, an average hydraulic gradient of 0.02, and an effective porosity of 0.20 (McClelland Engineers, 1987). It is believed that the discharge of groundwater by the numerous springs in the Gold Cup Springs Lake neighborhood into the ditch on E. Lakeside Drive, along with the routing of groundwater discharges by French drains installed by several residents on Valley Street, may significantly increase the rate of contaminant transport.



**FIGURE 3**

**WATER TABLE CONTOUR MAP  
SEPTEMBER 6, 1986**



**CONTAMINATION  
ASSESSMENT PLAN**

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HANAHAN, SOUTH CAROLINA**

### 3.0 PROPOSED ASSESSMENT PLAN

It is proposed that a two-phase field investigation be undertaken to assess the suspected contaminant plumes at the DFSP site. The phased approach is discussed in the following two sections. During both the Phase I and Phase II field investigations, the ABB-ES field leader will meet onsite or at SOUTHNAVFACENGCOM with the SOUTHNAVFACENGCOM Engineer-In-Charge (EIC) on a weekly basis to discuss the field investigation progress and findings. The Phase I and Phase II investigations will proceed with no stoppage of work between the phases.

3.1 PHASE I FIELD INVESTIGATION. The purpose of the Phase I investigations is to assess the approximate horizontal extent of the contaminant plumes in the areas where concentrations of petroleum contaminants are considered to be highest. This will be accomplished by obtaining groundwater samples from temporary wellpoints and soil samples from hand augered soil borings and screening the groundwater samples with a field gas chromatograph (GC) and the soil samples using an organic vapor analyzer (OVA). The information obtained during this field screening phase will assess the extent of the contaminant plumes and direct the placement of monitoring wells during the Phase II investigation.

Prior to the Phase I investigation, any necessary permits, off-site utility clearances, and right-of-way easements and private property access approvals will be obtained with the help of Navy personnel or their representatives. In addition, information on the location of potable water wells within a 1/4-mile radius of the site will be obtained from SOUTHNAVFACENGCOM, DFSP, SCDHEC, and previous investigation reports.

The Phase I field investigation will consist of installing as many as 37 temporary wellpoints along the western side of the DFSP site to assess the western contaminant plume. As many as 27 temporary wellpoints will be installed to assess the eastern and southern contaminant plume. As many as 10 temporary wellpoints will be installed to assess the contaminant plume identified southeast of tank 2 and extending along the eastern side of tank 5. The locations of the proposed temporary wellpoints are shown on Figure 4. ABB-ES proposes an additional 10 wellpoints be installed at the discretion of the field leader as dictated by the field GC results to further assess the contaminant plumes. These 10 wellpoints are not depicted on Figure 4.

The wellpoints will be installed using a KV Macho System™ or equivalent. The system consist of 3/4-inch outside diameter slotted, hollow, stainless-steel rods that are driven to below the water table using a vibratory hammer. Groundwater samples are withdrawn through the rod using a peristaltic pump.

Groundwater samples will be collected at each wellpoint location and screened for the presence of the petroleum contamination constituents BETX using a field GC. In addition, as many as 20 shallow soil borings will be conducted using a hand auger where possible at both the southern, eastern and western contaminated areas and the areas near tanks 2 and 5. Each soil boring will be advanced to a maximum depth of 9 feet bls or until groundwater is encountered. Three soil samples will be collected from each boring, one soil sample from each 3-foot interval beginning at the ground surface. These samples will be collected in each



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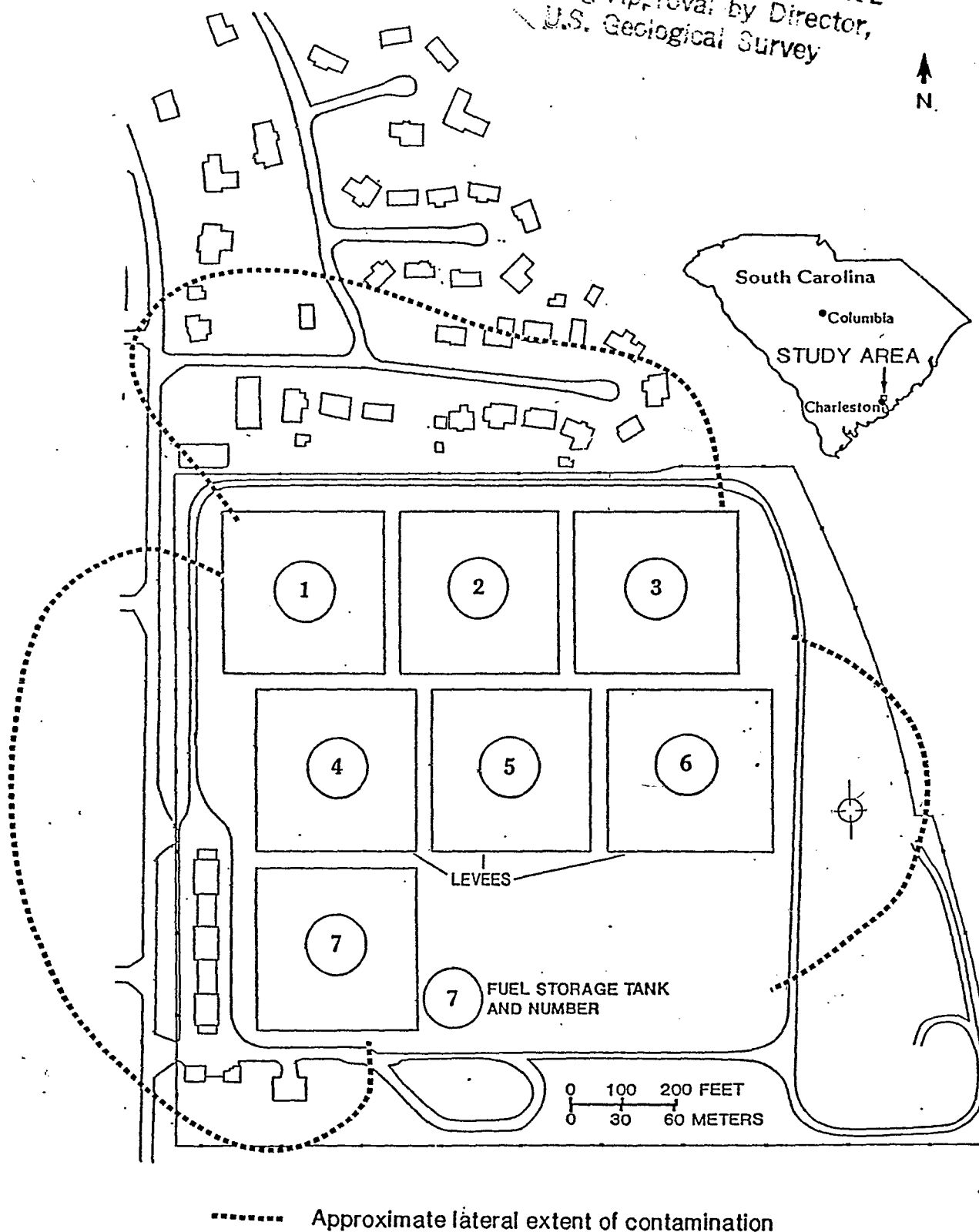
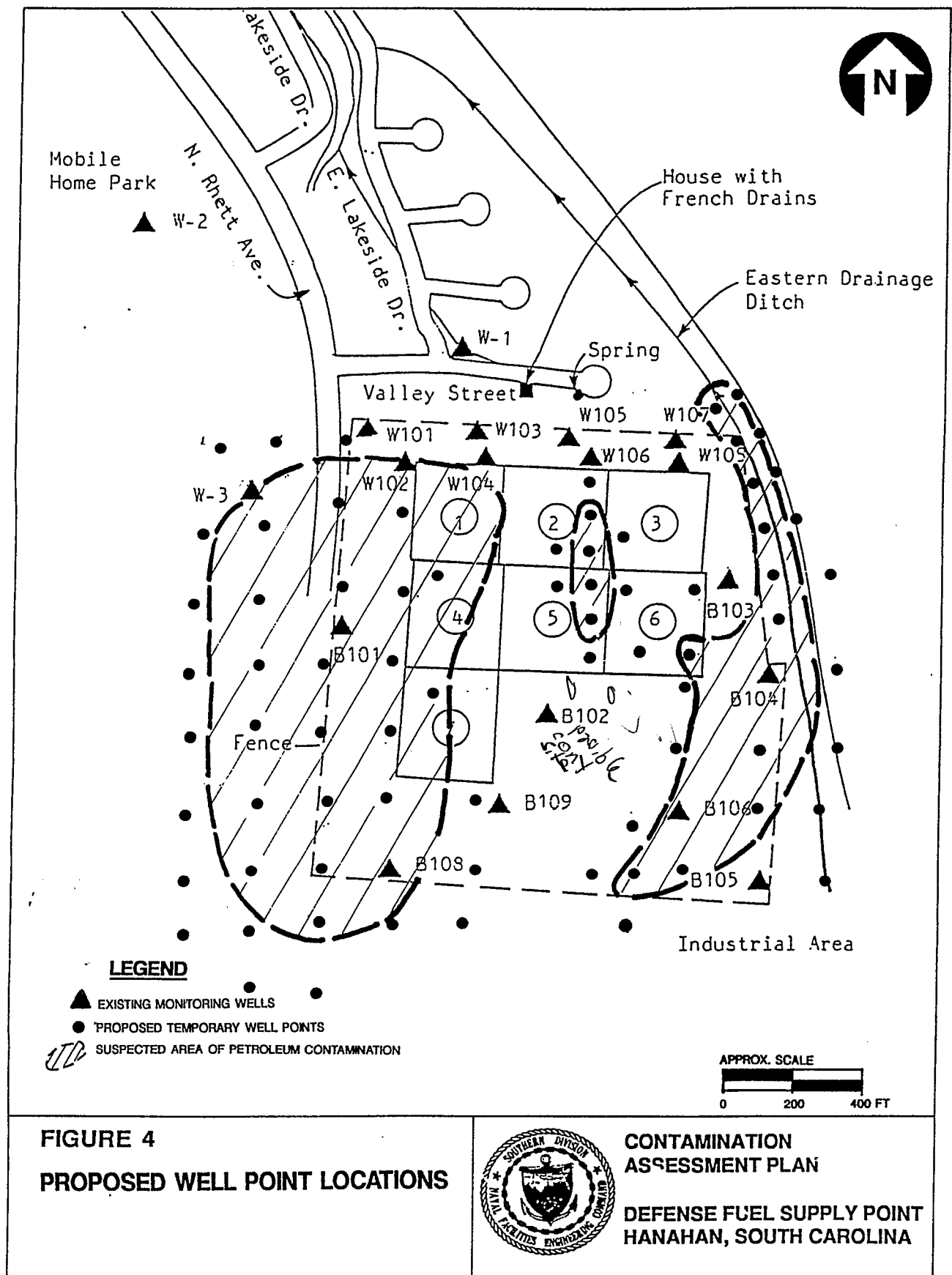


Figure 1.--Approximate lateral extent of contamination of all known plumes at the DFSP facility, November 1989 (RMT, Inc., 1990).



interval at the discretion of the field leader. Soil samples will be used to assess soil contamination and to describe the site-specific lithology. Soils will be classified in accordance with the Unified Soil Classification System. Soil samples for contaminant screening will be collected from each soil boring and placed in 16-ounce glass jars. The soil samples will be screened for petroleum contamination by head space analysis using an OVA equipped with a flame ionization detector (FID).

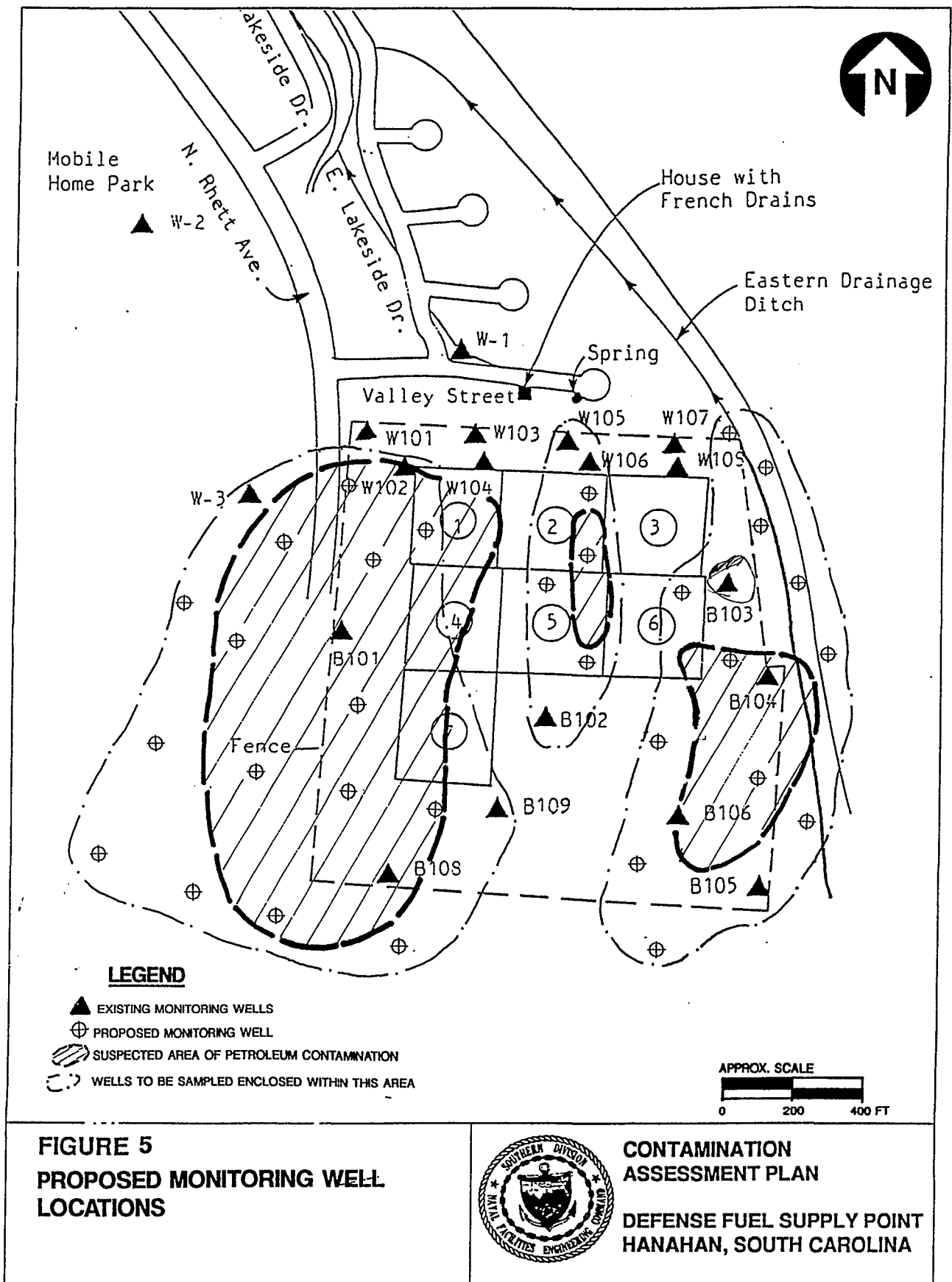
**3.2 PHASE II FIELD INVESTIGATION.** The purpose of the Phase II field investigation is to further assess the horizontal extent of the petroleum contamination in the southern, eastern, and western areas and the area near tanks 2 and 5 of the DFSP facility, assess the vertical extent of the petroleum contamination, and characterize the contamination. This will be accomplished through the drilling of soil borings in areas where hand augering could not take place to collect soil samples for OVA screening, the installation of permanent groundwater monitoring wells, the collection of groundwater samples from the monitoring wells for laboratory analysis of jet fuel constituents, surveying of the elevations of the monitoring wells to determine aquifer flow direction and gradient, and aquifer testing on select monitoring wells to estimate aquifer characteristics.

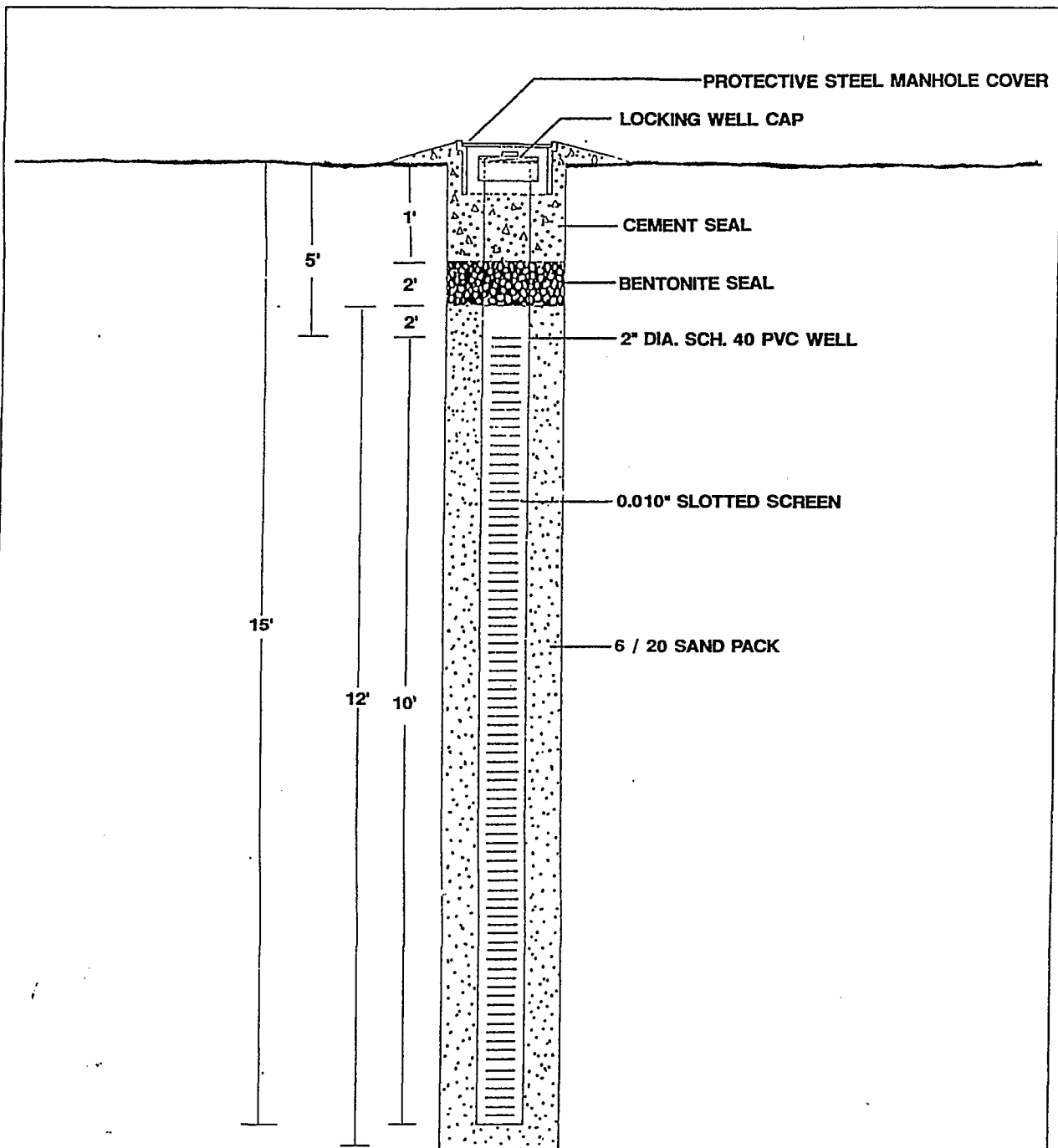
During the Phase II field investigation, 31 shallow monitoring wells (approximately 15 feet in depth) will be installed at the site to assess the contaminant plumes. The location of the proposed monitoring wells is shown on Figure 5; however, exact well placement will depend on the results of the Phase I investigation. All monitoring wells will be constructed of 2-inch inside diameter, flush threaded Schedule 40 polyvinyl chloride (PVC) screen and riser. The well screen will be comprised of a 10 foot section of 0.010-inch slotted screen. Well screens will be set such that a minimum of 2 feet of screen will be above the water table. Depth to the water table in existing wells will be measured to determine the depth interval for the well screen. The remainder of the well casing will consist of solid riser pipe to the ground surface. Total well length and depth for the shallow monitoring wells is not expected to exceed 15 feet bls.

The well annulus will be filter packed with No. 6-20 sand or an acceptable grade of sand to at least 1 foot above the well screen. A 2-foot bentonite seal will be placed above the sand pack with the remaining annular space grouted to the surface. Wells will be flush mounted with the ground surface and will consist of a locking protective cap and a steel subsurface vault set in the pavement around each well riser pipe. Typical construction details for the proposed monitoring wells are provided in Figure 6.

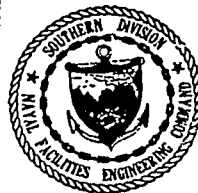
In addition to the monitoring wells, as many as 15 shallow soil borings will be advanced with a drill rig in those areas where it was not possible to perform the Phase I manual soil borings. Soil samples will be collected as described above and used for the same purposes.

Upon completion of the monitoring well installation, the wells will be developed using a centrifugal pump until the groundwater is sediment free or as clear as the aquifer will allow in a reasonable amount of time. The measuring point for groundwater elevation on the PVC riser pipe and the land surface adjacent to each monitoring well will be surveyed to within  $\pm 0.01$  foot based on an arbitrary reference elevation of 50 feet.





**FIGURE 6**  
**TYPICAL MONITORING WELL**  
**CONSTRUCTION DIAGRAM**



**CONTAMINATION**  
**ASSESSMENT PLAN**

**DEFENSE FUEL SUPPLY POINT**  
**HANAHAN, SOUTH CAROLINA**

Groundwater samples will be collected from the newly installed monitoring wells in addition to 12 existing wells (W-3, W102, W105, W106, B101 through B106, B108, and B109) at the site and analyzed for jet fuel constituents (U.S. Environmental Protection Agency (USEPA) Methods 602, 610, 239.2, and 8015 [extraction method 3510]). At the western contamination area, 20 groundwater samples will be collected; at the eastern and southern areas, 16 groundwater samples will be collected; and in the area near tanks 2 and 5, 7 groundwater samples will be collected. In addition, four duplicate samples, two equipment blanks, one field blank, and five trip blanks will be obtained.

Groundwater samples will be shipped via overnight carrier to an approved analytical laboratory. Sampling and the subsequent analytical program will comply with the ABB-ES' Comprehensive Quality Assurance Plan (ComQAP).

During the Phase I and II field investigations, ABB-ES personnel and their subcontractors will coordinate efforts with site personnel to dispose of contaminated fluids and soils. ABB-ES and their subcontractors will place any contaminated soils on plastic sheeting in an area approved by the facility manager. The soils will be encircled within a bermed area. The contaminated soil will be laid out in 6-inch deep layers on the plastic sheeting. The soils will be covered with plastic sheeting to prevent rainstorms from washing the soils away. At the time when remedial efforts are undertaken the soils will be disposed. Any contaminated fluids will be transported and deposited in a train tanker car that is kept at the facility for the purpose of disposal of waste fluids. It will be the Navy's responsibility to dispose of any hazardous waste that may be generated during this project.

3.3 PREPARATION OF REPORTS. Upon completion of the field investigations and receipt of the analytical laboratory results of the groundwater samples, draft, 100 percent complete, and final Contamination Assessment Reports (CARs) will be prepared and submitted to SOUTHNAVFACENGCOM and the Naval activity for review and approval. The reports will discuss site background information, site conditions, findings, and recommendations for the investigated areas of the DFSP site. Recommendations shall be made as to the need for any follow-up reports. Site location maps; locations of soil borings, wellpoints, and monitoring wells; groundwater contour maps; and contamination delineation maps will be included with the reports.

Based on the findings, conclusions, and recommendations of the final CAR, draft, 90 percent complete, 100 percent complete, and final follow-up reports will be prepared for the investigated areas of the DFSP site. The reports shall be either No Further Action Proposals (NOFAPs), Monitoring Only Proposals (MOPs), or Preliminary Remedial Action Plans (PRAPs).

If a PRAP is developed for the DFSP site it will include the following items:

- summary sheet of the CAR;
- general discussion of the technical and economic feasibility of remedial alternatives and more detailed information on the most feasible remedial system;
- general discussion of the rationale of the selected system;

- comparison of contaminant levels found with existing State and USEPA cleanup criteria in tabular format;
- disposition and expected contamination concentrations in any effluent from the proposed cleanup method;
- cost estimates and schedules for the design, construction, startup, and operational phases of remediation;
- designation of monitoring wells and proposed methodology for verifying accomplishment of PRAP goals (cleanup levels);
- details of any proposed treatment of contaminated soils;
- design and construction details;
- schedule for completion of the remedial action; and
- recommendations for conducting pilot studies and obtaining additional information.

Additional site information that may be needed to develop the performance specifications but not included in this scope is as follows:

- horizontal and vertical survey data,
- locations of existing utilities, and
- location and availability of electric power.











#### 4.0 SCHEDULE

A projected schedule to complete the Contamination Assessment field investigation is approximately 9 weeks. The field investigation is tentatively scheduled to begin the week of May 11, 1992. Upon completion of the field investigation, approximately 3 weeks will be required before receipt of the laboratory analyses of the groundwater samples that were collected during the investigation. A draft CAR will be prepared and submitted to SOUTHNAVENGCOM by August 6, 1992. If proper time schedules for report review are followed, a draft follow-up report has been scheduled to be delivered to SOUTHNAVFACENGCOM by October 13, 1992. A Gantt Chart outlining the project schedule is presented as Figure 7.



Task Name	Start Date	End Date	Duratn (Days)	91												92												93											
				May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb														
				1	3	1	1	3	1	1	2	2	3	2	1	1	1	1	3	1	1	2	1	4	1														
DFSP HANAHAN FIELD S.C.	15-Apr-91	12-Feb-93	462																																				
	15-Apr-91	12-Feb-93	462																																				
HANAHAN HASP & CAP	15-Apr-91	20-Mar-92	235																																				
	15-Apr-91	6-Feb-92	205																																				
PREPARE DRAFT HASP, QAP, & CAP	15-Apr-91	29-Apr-91	10																																				
	15-Apr-91	29-Apr-91	10																																				
SUBMIT DRFT HASP, CAP AND QAP	29-Apr-91	29-Apr-91	0																																				
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NAVY REVIEW DRFT HASP, CAP, & QAP	29-Apr-91	7-May-91	6																																				
	29-Apr-91	7-May-91	6																																				
PREPARE FINL DRFT HASP, CAP, QAP	7-May-91	17-May-91	8																																				
	7-May-91	17-May-91	8																																				
SUBMIT FINL DRFT HASP, CAP, & QAP	17-May-91	17-May-91	0																																				
	17-May-91	17-May-91	0																																				
NAVY REVIEW DRFT FINL HASP, ETC	20-May-91	18-Jun-91	20																																				
	20-May-91	18-Jun-91	20																																				
S CAROLINA REG AGENCY DELAY	18-Jun-91	8-Jan-92	139																																				
	18-Jun-91	8-Jan-92	139																																				
WAIT FOR RESPONSE FROM S.C.	18-Jun-91	8-Jan-92	139																																				
	18-Jun-91	8-Jan-92	139																																				
RCVD COMMENTS FROM S.C.(FAX)	8-Jan-92	8-Jan-92	0																																				
	8-Jan-92	8-Jan-92	0																																				
PREPARE FINAL HASP, CAP, & QAP	9-Jan-92	20-Mar-92	50																																				
	9-Jan-92	6-Feb-92	20																																				
SUBMIT FINAL HASP, CAP, & QAP	20-Mar-92	20-Mar-92	0																																				
	6-Feb-92	6-Feb-92	0																																				
HANAHAN FIELD INVESTIGATION	11-May-92	30-Jun-92	35																																				
	11-May-92	30-Jun-92	35																																				
LABORATORY ANALYSIS	30-Jun-92	22-Jul-92	15																																				
	30-Jun-92	22-Jul-92	15																																				
HANAHAN CAR	23-Jul-92	20-Nov-92	84																																				
	23-Jul-92	20-Nov-92	84																																				
PREPARE DRAFT CAR	23-Jul-92	6-Aug-92	10																																				
	23-Jul-92	6-Aug-92	10																																				
SUBMIT DRAFT CAR TO NAVY	6-Aug-92	6-Aug-92	0																																				
	6-Aug-92	6-Aug-92	0																																				
NAVY REVIEW OF DRAFT CAR	7-Aug-92	4-Sep-92	20																																				
	7-Aug-92	4-Sep-92	20																																				
PREPARE DRAFT FINAL CAR	8-Sep-92	29-Sep-92	15																																				
	8-Sep-92	29-Sep-92	15																																				
SUBMIT DRAFT FINAL CAR TO NAVY	29-Sep-92	29-Sep-92	0																																				
	29-Sep-92	29-Sep-92	0																																				
NAVY REVIEW OF DRAFT FINAL CAR	30-Sep-92	28-Oct-92	20																																				
	30-Sep-92	28-Oct-92	20																																				
PREPARE FINAL CAR	29-Oct-92	20-Nov-92	15																																				
	29-Oct-92	20-Nov-92	15																																				
SUBMIT FINAL CAR TO NAVY	20-Nov-92	20-Nov-92	0																																				
	20-Nov-92	20-Nov-92	0																																				
HANAHAN PRAP	8-Sep-92	12-Feb-93	108																																				
	8-Sep-92	12-Feb-93	108																																				
PREPARE DRAFT PRAP	8-Sep-92	13-Oct-92	25																																				
	8-Sep-92	13-Oct-92	25																																				
SUBMIT DRAFT PRAP TO NAVY	13-Oct-92	13-Oct-92	0																																				
	13-Oct-92	13-Oct-92	0																																				
NAVY REVIEW OF DRAFT PRAP	14-Oct-92	12-Nov-92	20																																				
	14-Oct-92	12-Nov-92	20																																				
PREPARE DRAFT FINAL PRAP	13-Nov-92	14-Dec-92	20																																				
	13-Nov-92	14-Dec-92	20																																				
SUBMIT DRAFT FINAL PRAP	14-Dec-92	14-Dec-92	0																																				
	14-Dec-92	14-Dec-92	0																																				
NAVY REVIEW OF DRFT FINAL PRAP	15-Dec-92	14-Jan-93	20																																				
	15-Dec-92	14-Jan-93	20																																				
PREPARE FINAL PRAP	14-Jan-93	12-Feb-93	20																																				
	14-Jan-93	12-Feb-93	20																																				
SUBMIT FINAL PRAP TO NAVY	12-Feb-93	12-Feb-93	0																																				

**LEGEND**

 Detail Task	 Summary Task	 Baseline
 (Progress)	 (Progress)	 Conflict
 (Slack)	 (Slack)	 Resource delay
Progress shows Percent Achieved on Actual		 Milestone
Scale: 8 hours per character		

**FIGURE 7**

### DFSP HANAHAN PROJECT GANTT CHART



## CONTAMINATION ASSESSMENT PLAN

**DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA**

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**SITE-SPECIFIC HEALTH AND SAFETY PLAN  
FOR  
CONTAMINATION ASSESSMENT INVESTIGATION**

**DEFENSE FUEL SUPPLY POINT  
HANAHAH, SOUTH CAROLINA**

**CTO NO.: 00010**

**Contract Number N62467-89-D-0317**

**Prepared by:**

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**Daryle Fontenot, Engineer-In-Charge**

**MARCH 1992**

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#### REFERENCES

The following chapters of the Comprehensive Long-term Environmental Action Navy (CLEAN) Program District I Generic HASP are applicable for the work anticipated at the site:

- ☒ 2.0 AUTHORITY AND RESPONSIBILITY OF HEALTH AND SAFETY PERSONNEL
- ☒ 3.0 TRAINING PROGRAM
- ☒ 4.0 MEDICAL SURVEILLANCE PROGRAM
- ☒ 5.0 ENGINEERING CONTROLS
- ☒ 6.0 PERSONAL PROTECTIVE LEVEL DETERMINATION
- ☒ 7.0 MONITORING EQUIPMENT
- ☐ 8.0 ZONATION
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- ☒ 13.0 DECONTAMINATION
- ☒ 14.0 EMERGENCY PLANNING
- ☒ 15.0 HEALTH AND SAFETY FORMS AND DATA SHEETS
  - ☐ HEALTH AND SAFETY AUDIT FORM
  - ☒ ACCIDENT REPORT FORM
  - ☒ HEALTH AND SAFETY OFFICER (HSO) CHECKLIST FOR FIELD OPERATIONS
  - ☒ MATERIAL SAFETY DATA SHEETS
  - ☐ LIQUI-NOX
  - ☐ ETHYL ALCOHOL (denatured)
  - ☐ TRISODIUM PHOSPHATE
  - ☒ OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) POSTER
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## 1.0 GENERAL

1.1 SCOPE AND PURPOSE. This Health and Safety Plan (HASP) has been prepared in conformance with the Navy CLEAN Program District I (CLEAN) HASP and is intended to meet the requirements of 29 Code of Federal Regulations (CFR) 1910.120. As such, the HASP addresses those activities associated with field operations for this project. Compliance with this HASP is required for all ABB-ES personnel, contractor personnel, or third parties entering the site.

### 1.2 PROJECT PERSONNEL.

1.2.1 Project Manager The project manager (PM) is the individual with overall project management responsibilities. Those responsibilities as they relate to health and safety include provision for the development of this site-specific HASP, the necessary resources to meet requirements of this HASP, the coordination of staff assignments to ensure that personnel assigned to the project meet medical and training requirements, and the means and materials necessary to resolve any health and safety issues that are identified or that develop on the project.

1.2.2 General Site Supervisor The General Site Supervisor is either the PM or the PM's designee who is on-site and vested with the authority by the PM to carry out day-to-day site operations, including interfacing with the site Health and Safety Officer (HSO).

1.2.3 Health and Safety Officer The HSO for this project has been designated by the PM with concurrence of the Health and Safety Supervisor (HSS) or Health and Safety Manager (HSM). The HSO will have at least an indirect line of reporting to the HSM through the HSS for the duration of his/her assignment as project HSO. The HSO is responsible for developing and implementing this site-specific HASP in accordance with the CLEAN HASP. The HSO will investigate all accidents, illnesses, and incidents occurring on-site. The HSO will also conduct safety briefings and site-specific training for on-site personnel. As necessary, the HSO will accompany all U.S. Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), or other governmental agency personnel visiting an ABB-ES site in response to health and safety issues. The HSO, in consultation with the HSS or HSM, is responsible for updating and modifying this HASP as site or environmental conditions change.

1.3 TRAINING. Training is defined under the CLEAN HASP, and all personnel entering potentially contaminated areas of this site must meet the requirements of 29 CFR 1910.120. Personnel without the required training will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 3.0 of the CLEAN HASP for further information.

1.4 MEDICAL SURVEILLANCE. All personnel entering potentially contaminated areas of this site will be medically qualified for site assignment through a medical surveillance program outlined in the CLEAN HASP. Personnel who have not received medical clearance will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 4.0 of the CLEAN HASP for further information.

## 2.0 SITE CHARACTERIZATION AND ANALYSIS

2.1 SITE NAME, LOCATION, AND SIZE. The Defense Fuel Supply Point (DFSP) site is located just east of North Rhett Boulevard approximately 3.5 miles east of Charleston Air Force Base within the city limits of Hanahan, South Carolina. The facility occupies approximately 48 acres.

2.2 SITE HISTORY AND LAYOUT. In September 1975, a leak developed in the bottom of one of seven 70,000 barrel capacity aboveground storage tanks. Approximately 83,000 gallons of JP-4 jet fuel was lost. The initial recovery operation recovered approximately 25 percent of the lost fuel. This leak occurred along the northern boundary of the property. Subsequent investigations from 1979 to 1990 indicated that petroleum contaminant plumes may exist along the eastern and western boundaries of the facility as a result of past spills and leaks.

2.3 SCOPE OF WORK (WORK PLAN). ABB-ES will conduct a contamination assessment along the eastern and western boundaries of the facility. The assessment will include shallow soil borings, collection of groundwater samples from temporary wellpoints, and the installation and sampling of permanent monitoring wells. The work will be conducted in Level D protective wear.

### 3.0 TASK ANALYSIS

#### 3.1 TASK ONE.

3.1.1 Hazardous Substances The contaminants of concern known or suspected to be present on-site, along with any established exposure limits for those substances are listed in Table 3-1.

3.1.2 Site Risks The following are the health hazards and safety hazards that are expected to be encountered at the site.

3.1.2.1 Health Hazards Contaminants to which personnel may be exposed are gasoline and diesel fuel and their constituents. The primary constituents of gasoline and diesel fuel that represent potential health hazards are described below and summarized in Table 3-1.

**BENZENE** is a watery, colorless liquid with a pleasant aromatic odor. It is a moderate irritant in small amounts both as a gas and as a liquid. If inhaled in large amounts it attacks the central nervous system, possibly resulting in coma and/or respiratory arrest. Chronic poisoning causes leukemia.

**ETHYL BENZENE** is a colorless aromatic liquid. It is a moderate skin irritant in gaseous form. Inhalation of high concentrations of the gas may cause temporary irritation of the nose, dizziness, and depression. The liquid form can blister the skin if not washed off immediately.

**TOLUENE** is a watery, colorless liquid with a pleasant aromatic odor. It is a mild skin irritant. Inhalation of high concentrations of the gas can cause temporary smarting of the eyes or irritation of the respiratory system. If the liquid form is allowed to remain on the skin for a long period of time, smarting and reddening of the skin may occur. Ingestion or aspiration of the liquid causes depressed respiration and pulmonary edema, and can result in kidney or liver damage.

**XYLENE** is a colorless, watery liquid with a sweet odor. It is a moderate skin irritant. When present as a gas in high concentrations, it can cause temporary slight smarting of the eyes or irritation of the respiratory system, headache, and dizziness. The liquid form may cause smarting or reddening of the skin if not washed off immediately. If the liquid is aspirated into the lungs it can result in severe coughing, distress, and rapidly developing pulmonary edema. If ingested, nausea, vomiting, cramps, headache, and coma can occur and may be fatal. Ingestion may also result in kidney and liver damage.

**POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs)**, for the purposes of this plan and study, include those listed as parameters for USEPA Method 610. Some of the more notable PAHs from this method include acenaphthene, anthracene, chrysene, fluorene, naphthalene, phenanthrene, and pyrene.

**Table 3-1**  
**Contaminants of Concern**

Health and Safety Plan  
Defense Fuel Supply Point  
Hanahan, South Carolina

Chemical	Approximate odor threshold (ppm)	Permissible Exposure Limits (ppm)	Threshold Limit Value (ppm)	Physical Characteristics	Dermal Toxicity	Remarks
Benzene	4.7	1	1	Colorless liquid, pleasant aromatic odor.	Moderate skin irritant.	Inhalation of large amounts attacks central nervous system (CNS); chronic poisoning causes leukemia.
Ethyl benzene	140	100	100	Colorless liquid, aromatic odor.	Moderate skin irritant.	Liquid blisters skin, inhalation results in dizziness, depression.
Toluene	0.17	100	100	Colorless liquid, pleasant aromatic odor.	Mild skin irritant.	Ingestion or aspiration can cause pulmonary edema, depressed respiration.
Xylene	0.05	100	100	Colorless liquid, aromatic odor.	Moderate skin irritant.	Inhalation causes headache and dizziness; vapors irritate eyes; can be fatal if ingested.
Naphthalene	--	10	10	Colorless to brown solid with an odor of mothballs	Moderate skin irritant	Inhalation causes headache and confusion; vapors irritate eyes.
Lead	--	--	--	Soft, ductile, gray, metal, soluble in water containing a weak acid.	--	Lead poisoning may cause fatigue, anemia, abdominal pains, and neurological damage.

Notes: ppm = parts per million.

In addition, care will be taken to avoid contact with the base neutral compounds that include naphthalene, phenanthrene, fluorene, and anthracene. Details of these compounds are listed in Section 4.0.

All activities at this site will be conducted in unconfined areas. This will minimize the chances of exposure of on-site personnel to either high vapor concentrations or strong liquid concentrations of any of the substances described above.

**3.1.2.2 Safety Hazards** Safety hazards include those hazards which personnel may be exposed to that are unrelated to hazardous wastes. These include hazards such as heat stress, operation and presence around heavy equipment, lifting of objects, vehicle traffic, and snake bites. Extreme caution should be exhibited by all personnel while conducting work around drill rigs, backhoes, and other heavy equipment. During hot days, personnel should take time to drink fluids and cool off to avoid overheating and symptoms related to heat stress.

Lifting of heavy objects should be done with caution. Personnel should assist one another with moving heavy objects or use the appropriate equipment to accomplish these tasks. During all site activities, personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes.

Power substations, powerlines, underground utilities, and underground pipelines are to be avoided during drilling operations. Information on underground utilities and scheduling of the field work at the facility will be coordinated with Mr. Don Matthews, the Quality Assurance Supervisor at DFSP Hanahan.

**3.1.2.3 Conclusions and Risk Assessment** Based on all of the available information (nature of the work, potential onsite chemicals and their properties, exposure limits, etc.), hazards associated with conducting the described field work are considered to be low, assuming appropriate health and safety practices are maintained.

**3.1.3 Protective Measures** The following are the protective measures that will be used at the site.

**3.1.3.1 Engineering Controls** Whenever needed, engineering controls (i.e., fans to blow volatilized chemicals away from the work area) will be used.

**3.1.3.2 Levels of Protection** A level D work uniform will be used at the site. Level D Protection should only be used when the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.

**3.1.4 Monitoring** It is intended that real time monitoring instrumentation will be used to monitor the work environment in order to ensure the appropriate level of protection for the site team.

**3.1.4.1 Air Sampling** To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the site, and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site. Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

1. Foxboro Organic Vapor Analyzer Model 128 (OVA)

If the OVA detects a steady measurable quantity of organic vapors greater than 5 ppm (above background conditions) in the breathing zone, the field team will withdraw from the site until health and safety conditions at the site are reevaluated.

**3.1.4.2 Personal Monitoring** Personal monitoring will be undertaken to characterize the personal exposure of high risk employees to the hazardous substances they may encounter on-site. Personal monitoring will be conducted on a representative basis. Personnel who are represented by the sampling will be noted in field logs.

The following personal monitoring equipment will be used at the site. Refer to Chapter 7.0 of the CLEAN HASP for information on the maintenance and calibration of the equipment.

1. Thermoluminescent Dosimetry Body Badge



#### 4.0 DATA SHEETS

# BENZENE

BNZ

Common Synonyms Benzol Benzole	Wettable liquid Colorless Gasoline-like odor
<p>Avoid contact with liquid and vapor. Keep people away. Wear goggles and self-contained breathing apparatus. Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>	
Fire	<p><b>FLAMMABLE.</b> Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>
Exposure	<p><b>CALL FOR MEDICAL AID.</b> <b>VAPOR</b> Irritating to eyes, nose and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. <b>LIQUID</b> Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.</p>
Water Pollution	<p><b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.</b> May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Restrict access</p>	
<p><b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3</p>	
<p><b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C<sub>6</sub>H<sub>6</sub> 3.3 IMO/UN Designation: 3.2/1114 3.4 DOT ID No.: 1114 3.5 CAS Registry No.: 71-43-2</p>	
<p><b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic, rather pleasant aromatic odor; characteristic odor</p>	
<p><b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a hose mask; hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield; hydrocarbon-insoluble apron such as neoprene. 5.2 Symptoms Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death. 5.3 Treatment of Exposure: SKIN: flush with water followed by soap and water, remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician. IF breathing is irregular or stopped, start resuscitation, administer oxygen. 5.4 Threshold Limit Value: 10 ppm 5.5 Short Term Inhalation Limit: 75 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3: LD<sub>50</sub> = 50 to 500 mg/kg 5.7 Late Toxicity: Leukemia 5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smearing and reddening of the skin. 5.10 Odor Threshold: 4.68 ppm 5.11 IDLH Value: 2,000 ppm</p>	

<p><b>6. FIRE HAZARDS</b> 6.1 Flash Point: 12°F C.C. 6.2 Flammable Limits in Air: 1.3%-7.8% 6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back 6.7 Ignition Temperature: 1097°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 6.0 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>	<p><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-U-V-W</p>
<p><b>7. CHEMICAL REACTIVITY</b> 7.1 Reactivity With Water: No reaction 7.2 Reactivity With Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 32</p>	<p><b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Flammable liquid 11.2 HAS Hazard Rating for Bulk Water Transportation: Category Rating Fire..... 3 Health..... 1 Vapor Irritant..... 1 Liquid or Solid Irritant..... 1 Poisons..... 3 Water Pollution Human Toxicity..... 3 Aquatic Toxicity..... 1 Aesthetic Effect..... 3 Reactivity Other Chemicals..... 2 Water..... 1 Self Reaction..... 0 11.3 NFPA Hazard Classification: Category Classification Health Hazard (Blue)..... 2 Flammability (Red)..... 3 Reactivity (Yellow)..... 0</p>
<p><b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 5 ppm/6 hr/minnow/lethal/distilled water 20 ppm/24 hr/sunfish/TL<sub>50</sub>/tap water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 1.2 lb/lb, 10 days 8.4 Food Chain Concentration Potential: None</p>	<p><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 16°C and 1 atm: Liquid 12.2 Molecular Weight: 78.11 12.3 Boiling Point at 1 atm: 176°F = 80.1°C = 353.3°K 12.4 Freezing Point: 42.0°F = 5.5°C = 276.7°K 12.5 Critical Temperature: 562.0°F = 288.9°C = 562.1°K 12.6 Critical Pressure: 710 psia = 48.3 atm = 4.89 MN/m<sup>2</sup> 12.7 Specific Gravity: 0.679 at 20°C (liquid) 12.8 Liquid Surface Tension: 28.5 dynes/cm = 0.0285 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 35.0 dynes/cm = 0.035 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: 2.7 12.11 Ratio of Specific Heats of Vapor (Gas): 1.061 12.12 Latent Heat of Vaporization: 169 Btu/lb = 54.1 cal/g = 3.54 X 10<sup>4</sup> J/kg 12.13 Heat of Combustion: -17,460 Btu/lb = -9595 cal/g = -406.0 X 10<sup>3</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 30.45 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 3.22 psia</p>
<p><b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Industrial pure ..... 99+ % Thiophene-free ..... 99+ % Nitration ..... 99+ % Industrial 90% ..... 85+ % Respect ..... 99+ % 9.2 Storage Temperature: Open 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum</p>	<p><b>NOTES</b></p>

JUNE 1985

# ETHYLBENZENE

ETB

Common Synonyms Phenylethane EB		Liquid	Colorless	Sweet, gasoline-like odor
Floats on water. Flammable, irritating vapor is produced.				
Avoid contact with liquid and vapor. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.				
Fire		FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.		
Exposure		CALL FOR MEDICAL AID  VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness or difficult breathing. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  LIQUID Will burn skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyes open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water. DO NOT INDUCE VOMITING.		
Water Pollution		HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Fouling to shoreward. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.		
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Mechanical containment Should be removed Chemical and physical treatment		2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3		
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Aromatic hydrocarbon 3.2 Formula: C <sub>8</sub> H <sub>10</sub> CH <sub>3</sub> 3.3 IMO/IUN Designation: 3.3/1175 3.4 DOT ID No: 1175 3.5 CAS Registry No: 100-41-4		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic		
5. HEALTH HAZARDS				
5.1 Personal Protective Equipment: Self-contained breathing apparatus; safety goggles.				
5.2 Symptoms Following Exposure: Inhalation may cause irritation of nose, dizziness, depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters.				
5.3 Treatment of Exposure: INHALATION: If ill effects occur, remove victim to fresh air, keep him warm and quiet, and get medical help promptly; if breathing stops, give artificial respiration. INGESTION: induce vomiting only upon physician's approval; material in lung may cause chemical pneumonia. SKIN AND EYES: promptly flush with plenty of water (15 min. for eyes) and get medical attention; remove and wash contaminated clothing before reuse.				
5.4 Threshold Limit Value: 100 ppm				
5.5 Short Term Inhalation Limits: 200 ppm for 30 min.				
5.6 Toxicity by Ingestion: Grade 2; LD <sub>50</sub> = 0.5 to 5 g/kg (rat)				
5.7 Late Toxicity: Data not available				
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.				
5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.				
5.10 Odor Threshold: 140 ppm				
5.11 IDLH Value: 2,000 ppm				

<div>6. FIRE HAZARDS</div> <div><div>6.1 Flash Point 60°F O.C.; 59°F C.C.</div><div>6.2 Flammable Limits in Air: 1.0%-6.7%</div><div>6.3 Fire Extinguishing Agents: Foam (most effective), water fog, carbon dioxide or dry chemical.</div><div>6.4 Fire Extinguishing Agents Not to be Used: Not pertinent</div><div>6.5 Special Hazards of Combustion Products: Irritating vapors are generated when heated.</div><div>6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to the source of ignition and flash back.</div><div>6.7 Ignition Temperature: 560°F</div><div>6.8 Electrical Hazard: Not pertinent</div><div>6.9 Burning Rate: 5.6 mm/min.</div><div>6.10 Adiabatic Flame Temperature: Data Not Available</div></div> <div>(Continued)</div>	<div>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U</div> <div>11. HAZARD CLASSIFICATIONS</div> <div><div>11.1 Code of Federal Regulations: Flammable liquid</div><div>11.2 NAS Hazard Rating for Bulk Water Transportation:<table><tr><th>Category</th><th>Rating</th></tr><tr><td>Fire.....</td><td>3</td></tr><tr><td>Health.....</td><td></td></tr><tr><td>Vapor Irritant.....</td><td>2</td></tr><tr><td>Liquid or Solid Irritant.....</td><td>2</td></tr><tr><td>Poisons.....</td><td>2</td></tr><tr><td>Water Pollution.....</td><td></td></tr><tr><td>Human Toxicity.....</td><td>1</td></tr><tr><td>Aquatic Toxicity.....</td><td>3</td></tr><tr><td>Aesthetic Effect.....</td><td>2</td></tr><tr><td>Reactivity.....</td><td></td></tr><tr><td>Other Chemicals.....</td><td>1</td></tr><tr><td>Water.....</td><td>0</td></tr><tr><td>Self Reaction.....</td><td>0</td></tr></table></div><div>11.3 NFPA Hazard Classification:<table><tr><th>Category</th><th>Classification</th></tr><tr><td>Health Hazard (Blue).....</td><td>2</td></tr><tr><td>Flammability (Red).....</td><td>3</td></tr><tr><td>Reactivity (Yellow).....</td><td>0</td></tr></table></div></div>	Category	Rating	Fire.....	3	Health.....		Vapor Irritant.....	2	Liquid or Solid Irritant.....	2	Poisons.....	2	Water Pollution.....		Human Toxicity.....	1	Aquatic Toxicity.....	3	Aesthetic Effect.....	2	Reactivity.....		Other Chemicals.....	1	Water.....	0	Self Reaction.....	0	Category	Classification	Health Hazard (Blue).....	2	Flammability (Red).....	3	Reactivity (Yellow).....	0
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<div>7. CHEMICAL REACTIVITY</div> <div><div>7.1 Reactivity With Water: No reaction</div><div>7.2 Reactivity with Common Materials: No reaction</div><div>7.3 Stability During Transport: Stable</div><div>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</div><div>7.5 Polymerization: Not pertinent</div><div>7.6 Inhibitor of Polymerization: Not pertinent</div><div>7.7 Molar Ratio (Reactant to Product): Data Not Available</div><div>7.8 Reactivity Group: 32</div></div>	<div>12. PHYSICAL AND CHEMICAL PROPERTIES</div> <div><div>12.1 Physical State at 15°C and 1 atm: Liquid</div><div>12.2 Molecular Weight: 106.17</div><div>12.3 Boiling Point at 1 atm: 277.2°F = 136.2°C = 409.4°K</div><div>12.4 Freezing Point: -139°F = -95°C = 178°K</div><div>12.5 Critical Temperature: 651.0°F = 343.9°C = 617.1°K</div><div>12.6 Critical Pressure: 529 psia = 35.6 atm = 3.61 MN/m²</div><div>12.7 Specific Gravity: 0.867 at 20°C (liquid)</div><div>12.8 Liquid Surface Tension: 29.2 dynes/cm = 0.0292 N/m at 20°C</div><div>12.9 Liquid Water Interfacial Tension: 35.48 dynes/cm = 0.03548 N/m at 20°C</div><div>12.10 Vapor (Gas) Specific Gravity: Not pertinent</div><div>12.11 Ratio of Specific Heats of Vapor (Gas): 1.071</div><div>12.12 Latent Heat of Vaporization: 144 Btu/lb = 80.1 cal/g = 3.35 X 10³ J/kg</div><div>12.13 Heat of Combustion: -17,780 Btu/lb = -9877 cal/g = -41.5 X 10³ J/kg</div><div>12.14 Heat of Decomposition: Not pertinent</div><div>12.15 Heat of Solution: Not pertinent</div><div>12.16 Heat of Polymerization: Not pertinent</div><div>12.17 Heat of Fusion: Data Not Available</div><div>12.18 Limiting Value: Data Not Available</div><div>12.19 Reid Vapor Pressure: 0.4 psia</div></div>																																				
<div>8. WATER POLLUTION</div> <div><div>8.1 Aquatic Toxicity: 29 ppm/96 hr/bluegill/TL<sub>50</sub>/fresh water</div><div>8.2 Waterfowl Toxicity: Data not available</div><div>8.3 Biological Oxygen Demand (BOD): 2.8% (theor.), 5 days</div><div>8.4 Food Chain Concentration Potential: None</div></div>																																					
<div>9. SHIPPING INFORMATION</div> <div><div>9.1 Grades of Purity: Research grade: 99.98%; pure grade: 99.5%; technical grade: 99.0%</div><div>9.2 Storage Temperature: Ambient</div><div>9.3 Inert Atmosphere: No requirement</div><div>9.4 Venting: Open (flame arrester) or pressure-vacuum</div></div>																																					
<div>6. FIRE HAZARDS (Continued)</div> <div><div>6.11 Stoichiometric Air to Fuel Ratio: Data Not Available</div><div>6.12 Flame Temperature: Data Not Available</div></div>																																					

## ETHYLENE DIBROMIDE

EDB

Common Synonyms	Liquid	Colorless	Sweet odor
1, 2-Dibromoethane Ethylene bromide Bromolene sym-Dibromoethane Dow-lume 40, W-10, W-15, W-40 Glycol dibromide	Sinks in water. Poisonous vapor is produced. Freezing point is 50°F.		
Stop discharge if possible. Keep people away. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.			
Fire	Not flammable. <b>POISONOUS GASES ARE PRODUCED WHEN HEATED.</b> Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Cool exposed containers with water.		
Exposure	CALL FOR MEDICAL AID.  VAPOR <b>POISONOUS IF INHALED.</b> Irritating to eyes, nose and throat. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  LIQUID <b>POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.</b> Irritating to skin and eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.		
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.		
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Should be removed Chemical and physical treatment		2. LABEL 2.1 Category: None 2.2 Class: Not pertinent	
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: BrCH <sub>2</sub> CH <sub>2</sub> Br 3.3 IMO/UN Designation: 6.1/1605 3.4 DOT ID No: 1605 3.5 CAS Registry No: 106-93-4		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Mildly sweet; like chloroform	
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Canister type mask or self-contained air mask; neoprene gloves; chemical safety goggles. 5.2 Symptoms Following Exposure: Local inflammation, blisters and ulcers on skin; irritation in lungs and organic injury to liver and kidneys; may be absorbed through skin. 5.3 Treatment of Exposure: Remove from exposure. Remove contaminated clothing. Wash skin with soap and water. Flush eyes with plenty of water. Consult physician. 5.4 Threshold Limit Value: 2 ppm 5.5 Short Term Inhalation Limit: 50 ppm for 5 min. 5.6 Toxicity by Ingestion: Grade 3; LD <sub>50</sub> = 50 to 500 mg/kg 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: Data not available 5.11 IDLH Value: 400 ppm			

6. FIRE HAZARDS 6.1 Flash Point: Not flammable 6.2 Flammable Limits in Air: Not flammable 6.3 Fire Extinguishing Agents: Not pertinent 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Decomposition gases are toxic and irritating. 6.6 Behavior in Fire: Decomposes into toxic irritating gases. Reacts with hot metals such as aluminum and magnesium. 6.7 Ignition Temperature: Not flammable 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Not flammable 6.10 Adiabatic Flame Temperature: Data Not Available 6.11 Stoichiometric Air to Fuel Ratio: Data Not Available 6.12 Flame Temperature: Data Not Available		10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-X	
7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data Not Available 7.8 Reactivity Group: 36		11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: ORM-A 11.2 NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire..... 0 Health..... Vapor Irritant..... 1 Liquid or Solid Irritant..... 1 Poisons..... 3 Water Pollution Human Toxicity..... 3 Aquatic Toxicity..... 3 Aesthetic Effect..... 2 Reactivity Other Chemicals..... 1 Water..... 0 Self Reaction..... 0 11.3 NFPA Hazard Classification: Category Classification Health Hazard (Blue)..... 3 Flammability (Red)..... 0 Reactivity (Yellow)..... 0	
8. WATER POLLUTION 8.1 Aquatic Toxicity: 16 mg/l/48 hr/bluegill/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: None		12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 187.86 12.3 Boiling Point at 1 atm: 256°F = 131°C = 404°K Freezing Point: 49.6°F = 9.6°C = 282.0°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 2.180 at 20°C (liquid) 12.8 Liquid Surface Tension: 36.75 dynes/cm = 0.03675 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 36.54 dynes/cm = 0.03654 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.109 12.12 Latent Heat of Vaporization: 62.1 Btu/lb = 45.6 cal/g = 1.91 X 10 <sup>3</sup> J/kg 12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.17 Heat of Fusion: 13.79 cal/g 12.18 Limiting Value: Data Not Available 12.19 Reid Vapor Pressure: 0.4 psia	
9. SHIPPING INFORMATION 9.1 Grades of Purity: Commercial 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum		NOTES	

# TETRAETHYL LEAD

TEL

<b>Common Synonyms</b> <b>TEL</b> Lead tetraethyl	<b>Oil liquid</b> <b>Colorless, but generally dyed red</b> <b>Fruity odor</b>  Sinks in water. Poisonous, flammable vapor is produced.
<b>AVOID CONTACT WITH LIQUID AND VAPOR.</b> Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Stop discharge if possible. Call fire department. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.	
<b>Fire</b>	<b>Combustible.</b> <b>POISONOUS GASES ARE PRODUCED IN FIRE.</b> Containers may explode in fire. Vapor may explode if ignited in an enclosed area. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).  Combat fires from behind barrier or protected location. Flood discharge area with water. Extinguish with water, dry chemical, foam, or carbon dioxide. Cool exposed containers with water.
<b>Exposure</b>	<b>CALL FOR MEDICAL AID.</b>  <b>VAPOR</b> <b>POISONOUS IF INHALED OR IF SKIN IS EXPOSED.</b> Irritating to eyes. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  <b>LIQUID</b> <b>POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.</b> Will burn eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.
<b>Water Pollution</b>	<b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.</b> May be dangerous if it enters water intakes.  Notify local health and wildlife officials. Notify operators of nearby water intakes.
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-poison, water contaminant Restrict access Should be removed Chemical and physical treatment	
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Not listed 3.2 Formula: $Pb(C_2H_5)_4$ 3.3 IMO/IUN Designation: 6.1/1649 3.4 DOT ID No.: 1649 3.5 CAS Registry No.: 76-00-2	
<b>5. HEALTH HAZARDS</b>  5.1 Personal Protective Equipment: Organic vapor type canister face mask for short periods; air line type for longer periods; neoprene-coated, liquid-proof gloves; protective goggles or face shield; white or light-colored clothing; rubber shoes or boots. 5.2 Symptoms Following Exposure: Increased urinary output of lead. If a large degree of absorption from inhalation or skin contact, may cause insomnia, excitability, delirium, coma and death. Do not confuse with inorganic lead. 5.3 Treatment of Exposure: Remove victim from contaminated area and consult physician immediately. <b>INGESTION:</b> Induce vomiting. <b>SKIN:</b> Wash immediately with kerosene or similar petroleum distillate followed by soap and water. 5.4 Threshold Limit Value: 0.1 mg/m <sup>3</sup> 5.5 Short Term Inhalation Limit: 0.15 mg Pb/m <sup>3</sup> for 30 min. 5.6 Toxicity by Ingestion: Oral rat LD <sub>50</sub> = 17 mg/kg 5.7 Late Toxicity: Lead poisoning 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight stinging of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Causes stinging of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure. 5.10 Odor Threshold: Data not available 5.11 IDLH Value: 40 mg/m <sup>3</sup>	
<b>2. LABEL</b> 2.1 Category: Poison 2.2 Class: 6	<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Dyed red or other distinctive color. 4.3 Odor: Sweet

<b>6. FIRE HAZARDS</b> 6.1 Flash Point: 200°F C.C.; 155°F O.C. 6.2 Flammable Limits in Air: Data not available 6.3 Fire Extinguishing Agents: Water, foam, dry chemical, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion: Products: Toxic gases are generated in fires. 6.6 Behavior in Fire: May explode in fires. 6.7 Ignition Temperature: Decomposes above 230°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Data not available 6.10 Adiabatic Flame Temperature: Data not available  (Continued)	<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-X-Y								
<b>7. CHEMICAL REACTIVITY</b> 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: Rust and some metals cause decomposition. 7.3 Stability During Transport: Stable below 230°F. At higher temperatures, may detonate or explode when confined. 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: Data not available	<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Poison, B 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: <table> <tr> <th>Category</th><th>Classification</th></tr> <tr> <td>Health Hazard (Blue).....</td><td>3</td></tr> <tr> <td>Flammability (Red).....</td><td>2</td></tr> <tr> <td>Reactivity (Yellow).....</td><td>3</td></tr> </table>	Category	Classification	Health Hazard (Blue).....	3	Flammability (Red).....	2	Reactivity (Yellow).....	3
Category	Classification								
Health Hazard (Blue).....	3								
Flammability (Red).....	2								
Reactivity (Yellow).....	3								
<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 0.20 mg/l/96 hr/bluegill/TL <sub>50</sub> /fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: Data not available	<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 322.44 12.3 Boiling Point at 1 atm: Decomposes 12.4 Freezing Point: -215°F = -157°C = 136°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.633 at 20°C (liquid) 12.8 Liquid Surface Tension: 26.5 dynes/cm = 0.0265 N/m at (est.) 25°C 12.9 Liquid Water Interfacial Tension: (est.) 40 dynes/cm = 0.04 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: (est.) -7,670 Btu/lb = -4,380 cal/g = -183 X 10 <sup>3</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.17 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available								
<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Technical 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum									
<b>6. FIRE HAZARDS (Continued)</b> 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available									

# TOLUENE

TOL

Common Synonyms		Watery liquid	Colorless	Pleasant odor
Toluol Methylbenzene Methylbenzol		Floats on water. Flammable, irritating vapor is produced.		
Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to "knock down" vapor. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.				
Fire	FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.			
Exposure	CALL FOR MEDICAL AID.  VAPOR Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing difficult, give oxygen.  LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.			
Water Pollution	Dangerous to aquatic life in high concentrations. Fouling to shoreline. May be dangerous if it enters water intakes.  Notify local health and wildlife officials. Notify operators of nearby water intakes.			
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Evacuate area		2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3		
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C <sub>6</sub> H <sub>5</sub> CH <sub>3</sub> 3.3 IMO/UN Designation: 3.2/1264 3.4 DOT ID No.: 1264 3.5 CAS Registry No.: 106-86-3		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant		
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves. 5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration. 5.3 Treatment of Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limits: 600 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 2; LD <sub>50</sub> = 0.5 to 5 g/kg 5.7 Late Toxicity: Kidney and liver damage may follow ingestion. 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.17 ppm 5.11 IDLH Value: 2,000 ppm				

<div>6. FIRE HAZARDS</div> <div>6.1 Flash Point: 40°F C.C.; 55°F O.C.</div> <div>6.2 Flammable Limits in Air: 1.27%-7%</div> <div>6.3 Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires.</div> <div>6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective</div> <div>6.5 Special Hazards of Combustion Products: Not pertinent</div> <div>6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.</div> <div>6.7 Ignition Temperature: 997°F</div> <div>6.8 Electrical Hazard: Class I, Group D</div> <div>6.9 Burning Rate: 5.7 mm/min.</div> <div>6.10 Adiabatic Flame Temperature: Data not available</div> <div>(Continued)</div>	<div>10. HAZARD ASSESSMENT CODE</div> <div>(See Hazard Assessment Handbook)</div> <div>A-T-U</div>																																				
<div>7. CHEMICAL REACTIVITY</div> <div>7.1 Reactivity With Water: No reaction</div> <div>7.2 Reactivity with Common Materials: No reaction</div> <div>7.3 Stability During Transport: Stable</div> <div>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</div> <div>7.5 Polymerization: Not pertinent</div> <div>7.6 Inhibitor of Polymerization: Not pertinent</div> <div>7.7 Molar Ratio (Reactant to Product): Data not available</div> <div>7.8 Reactivity Group: 32</div>	<div>11. HAZARD CLASSIFICATIONS</div> <div>11.1 Code of Federal Regulations: Flammable liquid</div> <div>11.2 NAS Hazard Rating for Bulk Water Transportation:</div> <table><thead><tr><th>Category</th><th>Rating</th></tr></thead><tbody><tr><td>Fire.....</td><td>3</td></tr><tr><td>Health.....</td><td></td></tr><tr><td>Vapor Irritant.....</td><td>1</td></tr><tr><td>Liquid or Solid Irritant.....</td><td>1</td></tr><tr><td>Poisons.....</td><td>2</td></tr><tr><td>Water Pollution.....</td><td></td></tr><tr><td>Human Toxicity.....</td><td>1</td></tr><tr><td>Aquatic Toxicity.....</td><td>3</td></tr><tr><td>Aesthetic Effect.....</td><td>2</td></tr><tr><td>Reactivity.....</td><td></td></tr><tr><td>Other Chemicals.....</td><td>1</td></tr><tr><td>Water.....</td><td>0</td></tr><tr><td>Self Reaction.....</td><td>0</td></tr></tbody></table> <div>11.3 NFPA Hazard Classification:</div> <table><thead><tr><th>Category</th><th>Classification</th></tr></thead><tbody><tr><td>Health Hazard (Blue).....</td><td>2</td></tr><tr><td>Flammability (Red).....</td><td>3</td></tr><tr><td>Reactivity (Yellow).....</td><td>0</td></tr></tbody></table>	Category	Rating	Fire.....	3	Health.....		Vapor Irritant.....	1	Liquid or Solid Irritant.....	1	Poisons.....	2	Water Pollution.....		Human Toxicity.....	1	Aquatic Toxicity.....	3	Aesthetic Effect.....	2	Reactivity.....		Other Chemicals.....	1	Water.....	0	Self Reaction.....	0	Category	Classification	Health Hazard (Blue).....	2	Flammability (Red).....	3	Reactivity (Yellow).....	0
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<div>8. WATER POLLUTION</div> <div>8.1 Aquatic Toxicity: 1180 mg/l/96 hr/sunfish/TL<sub>50</sub>/fresh water</div> <div>8.2 Waterfowl Toxicity: Data not available</div> <div>8.3 Biological Oxygen Demand (BOD): 0%, 5 days; 38% (theor), 6 days</div> <div>8.4 Food Chain Concentration Potential: None</div>	<div>12. PHYSICAL AND CHEMICAL PROPERTIES</div> <div>12.1 Physical State at 15°C and 1 atm: Liquid</div> <div>12.2 Molecular Weight: 92.14</div> <div>12.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K</div> <div>12.4 Freezing Point: -139°F = -95.0°C = 178.2°K</div> <div>12.5 Critical Temperature: 605.4°F = 316.6°C = 591.8°K</div> <div>12.6 Critical Pressure: 596.1 psia = 40.55 atm = 4.108 MN/m<sup>2</sup></div> <div>12.7 Specific Gravity: 0.867 at 20°C (liquid)</div> <div>12.8 Liquid Surface Tension: 29.0 dynes/cm = 0.0290 N/m at 20°C</div> <div>12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25°C</div> <div>12.10 Vapor (Gas) Specific Gravity: Not pertinent</div> <div>12.11 Ratio of Specific Heats of Vapor (Gas): 1.089</div> <div>12.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 5.61 X 10<sup>3</sup> J/kg</div> <div>12.13 Heat of Combustion: -17,430 Btu/lb = -9666 cal/g = -405.5 X 10<sup>3</sup> J/kg</div> <div>12.14 Heat of Decomposition: Not pertinent</div> <div>12.15 Heat of Solution: Not pertinent</div> <div>12.16 Heat of Polymerization: Not pertinent</div> <div>12.25 Heat of Fusion: 17.17 cal/g</div> <div>12.26 Limiting Value: Data not available</div> <div>12.27 Reid Vapor Pressure: 1.1 psia</div>																																				
<div>9. SHIPPING INFORMATION</div> <div>9.1 Grades of Purity: Research, reagent, industrial-all 99.8 + %; industrial: contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 90/120: less pure than industrial.</div> <div>9.2 Storage Temperature: Ambient</div> <div>9.3 Inert Atmosphere: No requirement</div> <div>9.4 Venting: Open (flame arrester) or pressure-vacuum</div>	<div>6. FIRE HAZARDS (Continued)</div> <div>6.11 Stoichiometric Air to Fuel Ratio: Data not available</div> <div>6.12 Flame Temperature: Data not available</div>																																				

JUNE 1985

# m-XYLENE

XLM

Common Synonyms 3-Dimethylbenzene .xylol		Watery liquid	Colorless	Sweet odor
Floats on water. Flammable, irritating vapor is produced.				
Stop discharge if possible. Keep people away. Call fire department. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.				
Fire	<b>FLAMMABLE</b> Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear self-contained breathing apparatus. Extinguish with foam, dry chemical, or carbon dioxide. Water may be ineffective or fire. Cool exposed containers with water.			
Exposure	<b>CALL FOR MEDICAL AID.</b>  <b>VAPOR</b> Irritating to eyes, nose, and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  <b>LIQUID</b> Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. If IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. <b>DO NOT INDUCE VOMITING.</b>			
Water Pollution	<b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.</b> Fouling to shoreline. May be dangerous if it enters water intakes.  Notify local health and wildlife officials. Notify operators of nearby water intakes.			
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Evacuate area Should be removed Chemical and physical treatment		2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3		
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: m-C <sub>6</sub> H <sub>4</sub> (CH <sub>3</sub> ) <sub>2</sub> 3.3 IMO/UN Designation: 3.2/1307 3.4 DOT ID No: 1307 3.5 CAS Registry No: 105-36-3		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Like benzene; characteristic aromatic		
5. HEALTH HAZARDS				
5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.				
5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma; can be fatal. Kidney and liver damage can occur.				
5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.				
5.4 Threshold Limit Value: 100 ppm				
5.5 Short Term Inhalation Limit: 300 ppm for 30 min.				
5.6 Toxicity by Ingestion: Grade 3; LD <sub>50</sub> = 50 to 500 g/kg				
5.7 Lethal Toxicity: Kidney and liver damage.				
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.				
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.				
5.10 Odor Threshold: 0.05 ppm				
5.11 IDLH Value: 10,000 ppm				

6. FIRE HAZARDS		10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U	
6.1 Flash Point: 54°F C.C.		11. HAZARD CLASSIFICATIONS	
6.2 Flammable Limits in Air: 1.1%-6.4%		11.1 Code of Federal Regulations: Flammable liquid	
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide		11.2 NAS Hazard Rating for Bulk Water Transportation:	
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.		Category Rating	
6.5 Special Hazards of Combustion Products: Not pertinent		Fire..... 3	
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.		Health..... 1	
6.7 Ignition Temperature: 985°F		Vapor Irritant..... 1	
6.8 Electrical Hazard: Class I, Group D		Liquid or Solid Irritant..... 1	
6.9 Burning Rate: 5.8 mm/min.		Poisons..... 2	
6.10 Adiabatic Flame Temperature: Data not available		Water Pollution	
6.11 Stoichiometric Air to Fuel Ratio: Data not available		Human Toxicity..... 1	
6.12 Flame Temperature: Data not available		Aquatic Toxicity..... 3	
7. CHEMICAL REACTIVITY		Aesthetic Effect..... 2	
7.1 Reactivity With Water: No reaction		Reactivity	
7.2 Reactivity With Common Materials: No reaction		Other Chemicals..... 1	
7.3 Stability During Transport: Stable		Water..... 0	
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent		Self Reaction..... 0	
7.5 Polymerization: Not pertinent		11.3 NFPA Hazard Classification:	
7.6 Inhibitor of Polymerization: Not pertinent		Category Classification	
7.7 Molar Ratio (Reactant to Product): Data not available		Health Hazard (Blue)..... 2	
7.8 Reactivity Group: 32		Flammability (Red)..... 3	
8. WATER POLLUTION		Reactivity (Yellow)..... 0	
8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL <sub>50</sub> /fresh water		12. PHYSICAL AND CHEMICAL PROPERTIES	
8.2 Waterfowl Toxicity: Data not available		12.1 Physical State at 15°C and 1 atm:	
8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor), 8 days		Liquid	
8.4 Food Chain Concentration Potential: Data not available		12.2 Molecular Weight: 106.16	
9. SHIPPING INFORMATION		12.3 Boiling Point at 1 atm: 259.4°F = 131.9°C = 405.1°K	
9.1 Grades of Purity: Research: 99.99%; Pure: 99.9%; Technical: 99.2%		12.4 Freezing Point: -54.2°F = -47.9°C = 225.3°K	
9.2 Storage Temperature: Ambient		12.5 Critical Temperature: 650.8°F = 343.8°C = 617.0°K	
9.3 Inert Atmosphere: No requirement		12.6 Critical Pressure: 513.6 atm = 34.95 psia = 3.540 MN/m <sup>2</sup>	
9.4 Venting: Open (flame arrester) or pressure-vacuum		12.7 Specific Gravity: 0.864 at 20°C (liquid)	
NOTES		12.8 Liquid Surface Tension: 26.6 dynes/cm = 0.0286 N/m at 20°C	
		12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0364 N/m at 30°C	
		12.10 Vapor (Gas) Specific Gravity: Not pertinent	
		12.11 Ratio of Specific Heats of Vapor (Gas): 1.071	
		12.12 Latent Heat of Vaporization: 147 Btu/lb = 81.9 cal/g = 3.43 X 10 <sup>5</sup> J/kg	
		12.13 Heat of Combustion: -17,554 Btu/lb = -8752.4 cal/g = -406.31 X 10 <sup>3</sup> J/kg	
		12.14 Heat of Decomposition: Not pertinent	
		12.15 Heat of Solution: Not pertinent	
		12.16 Heat of Polymerization: Not pertinent	
		12.17 Heat of Fusion: 26.01 cal/g	
		12.18 Limiting Value: Data not available	
		12.19 Reid Vapor Pressure: 0.34 psia	

## Diesel Oil (fuel oil #2)

...  
Physical and chemical description: flammable, slightly viscous brown liquid obtained from the distillation of crude petroleum. Diesel oil is a mixture of hydrocarbons, predominately unbranched alkanes of 10-16 carbon atoms with smaller amounts of aromatic and polynuclear aromatic hydrocarbons (PAH's). Diesel oil floats on water, having a specific gravity of less than 1.

Uses: fuel for trucks, ships, and trains.

Toxicity: Because of their water solubility and carcinogenicity, benzene and PAH's are the chemicals of health concern in diesel oil. Benzene, found in trace amounts in diesel oil, is known to cause leukemia, a cancer of the blood forming cells. PAH's as a class (1-10% in diesel) are considered to be carcinogenic to a number of animal species. Benzo(a)pyrene is one of the most commonly found and carcinogenic PAH. The alkanes of 10-16 carbon atoms, which make up the bulk of diesel oil, are of less concern due to their very low water solubility and low toxicity.

Concentration Guidelines and Standards: The maximum tolerable concentration for diesel oil in drinking water is 100 ug/l, due to organoleptic (taste and smell) considerations. The EPA Office of Drinking Water recommends that the short term concentrations of PAH's in drinking water not exceed 25 ug/l. This is the 7 day suggested no adverse response level (SNARL) and does not take into account the long term cancer risk. These concentrations should be tolerated only in emergency situations where no other higher quality water source is available.



Naphthalene (C<sub>10</sub>H<sub>8</sub>)

Physical and Chemical Description: white crystalline solid with a characteristic "moth ball" odor. Naphthalene is more dense than water (sp. gr. 1.145) and has a solubility of 30,000 - 40,000 ug/l @ 25°C. It melts at 80°C but will sublime (volatilize from a solid) at room temperature. Naphthalene is considered a polynuclear aromatic hydrocarbon (PAH).

Uses: intermediate in dye production and formation of solvents, lubricants, and motor fuels. Used directly as a moth repellant.

Toxicity: Naphthalene may be absorbed by inhalation, ingestion or skin or eye contact. Chronic exposure can cause cataracts, kidney disease and red blood cell breakdown, especially in infants and individuals deficient in the enzyme G6PD. Naphthalene has been shown to be nonmutagenic and noncarcinogenic.

Classification: Hazardous Substance (EPA)

Hazardous Waste (EPA)

Priority Toxic Pollutant (EPA)

Persistence: Naphthalene can oxidize in the presence of light and air, 50% after 14 days in one study. Microbial degradation has also been demonstrated in the laboratory in solutions as concentrated as 3.3 ug/l. Little breakdown is expected, however, under the dark, anaerobic conditions characteristic of in-situ ground water.

Phenanthrene (C<sub>14</sub>H<sub>10</sub>)

Physical and Chemical Description: colorless, monoclinic crystals soluble in water, 1,000-1,300 ug/l @ 2.5°C, specific gravity = 1.179.

Phenanthrene is a PAH.

Uses: dyes, explosives, a natural constituent of coal tar and of diesel oil (0.35%).

Toxicity: Phenanthrene has been identified as a mild allergen and human dermal photosensitizer. Limited acute and chronic animal experiments show it to be of low to moderate toxicity.

Classification: none

Fluorene (C<sub>13</sub>H<sub>10</sub>)

Physical and Chemical Description: Combustible white solid having a density of 1.20 and a water solubility of 1980 ug/l.

Uses: Manufacture of dyestuffs.

Toxicity: Little specific information is available about the toxicity of fluorene but it is a polynuclear aromatic hydrocarbon (PAH), a group which contains known human carcinogens.

Classification: None

## 5.0 SITE CONTROL

5.1 ZONATION. Due to the nature of the work (multiple soil borings and well installations throughout the study area) and the properties of the potential chemicals found onsite, typical exclusion, contamination reduction, and support zones are not necessary or practical at all locations. Therefore, where appropriate, a "floating" exclusion zone in the perimeter of the sampling site will be established to eliminate access to the area by individuals not working on the project or involved in the assessment work. The perimeter will be at least 20 feet in radius and moved accordingly as the assessment points are moved.

5.2 COMMUNICATIONS. When radio communication is not used, the following air horn signals will be employed:

HELP	three short blasts	( . . . )
EVACUATION	three long blasts	( _ _ _ )
ALL CLEAR	alternating long and short blasts	( _ . _ . )

5.3 WORK PRACTICES. General work practices to be used during ABB-ES projects are described in Chapter 9.0 of the CLEAN HASP. Work at the site will be conducted according to these established protocol and guidelines for the safety and health of all involved. Specific work practices necessary for this project or those that are of significant concern are described as follows.

- Work and sampling will be conducted in Level D clothing and equipment.

## 6.0 DECONTAMINATION AND DISPOSAL

All personnel and/or equipment leaving contaminated areas of the site will be subject to decontamination, which will take place in the contamination reduction zone. General decontamination practices used during ABB-ES projects are described in Chapter 13.0 of the CLEAN HASP.

6.1 PERSONNEL DECONTAMINATION. All personnel leaving the study area are subject to decontamination (as necessary). The decontamination procedure required will be determined by the nature and level of contamination found at the sites. At a minimum, site personnel will remove loose soils from boots and clothing before leaving the site. More thorough decontamination procedures will be observed as dictated by site conditions. These procedures are described in Chapter 13.0 of the CLEAN HASP.

6.1.1 Small Equipment Decontamination Small equipment will be protected from contamination as much as possible by keeping the equipment covered when at the site and placing the equipment on plastic sheeting, not the ground. Sampling equipment used at the site will be used only once or will be field cleaned between samples with soapy water (Alconox), rinsed with clean water, rinsed with an approved Quality Assurance/Quality Control solvent, and final rinsed with organic free water.

6.1.2 Heavy Equipment Decontamination Drilling equipment will be protected from contamination as much as possible by placing the equipment on plastic sheeting, not the ground. The drill rig and associated drilling equipment will be cleaned with high pressure water or high pressure steam followed by a soap and water wash and rinse. Loose material will be removed by brush. The person performing this activity will be at the level of protection used during the field investigation.

6.2 COLLECTION AND DISPOSAL OF DECONTAMINATION PRODUCTS. All disposable protective gear, decontamination fluids (for both personnel and equipment), and other disposable materials will be disposed of at the site. Decontamination fluids (i.e., isopropanol [e.g., split spoons and groundwater sampling pump]) will be stored in amber glass bottles. Disposable materials (e.g., gloves and Tyveks<sup>TM</sup>) will be bagged and disposed of properly.

## 7.0 EMERGENCY AND CONTINGENCY PLAN

This section identifies emergency and contingency planning that has been undertaken for operations at this site. Most sections of the HASP provide information that would be used under emergency conditions. General emergency planning information is addressed in Chapter 14.0 of the CLEAN HASP. The following subsections present site-specific emergency and contingency planning information.

7.1 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATIONS. The site HSO or the Health and Safety designee is the primary authority for directing operations at the site under emergency conditions. All communications both on- and off-site will be directed through the HSO or designee.

7.2 EVACUATION. Evacuation procedures at the site will follow those procedures discussed in Chapter 14.5 of the CLEAN HASP for upwind withdrawal, site evacuation, and evacuation of the surrounding area. Evacuation from the DFSP facility will be conducted with all personnel meeting at the main facility gate at the northwest corner of the site. Evacuation will proceed by travelling south (left) on North Rhett Boulevard, away from the site.

7.3 EMERGENCY MEDICAL TREATMENT AND FIRST AID. Any personnel injured on-site will be rendered first aid as appropriate and transported to competent medical facilities for further examination and/or treatment. The preferred method of transport would be through professional emergency transportation means; however, when this is not readily available or would result in excessive delay, other transport will be authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

## 8.0 ADMINISTRATION

8.1 PERSONNEL AUTHORIZED DOWNRANGE. Personnel authorized to participate in downrange activities at this site have been reviewed and certified for site operations by the Project Manager and the HSS. Certification involves the completion of appropriate training, a medical examination, and a review of this site-specific HASP. All persons entering the site must use the buddy system, and check in with the Site Manager and/or HSO before going downrange.

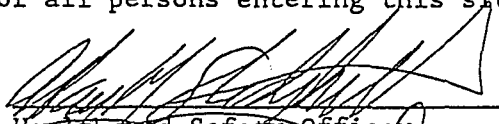
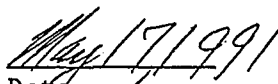
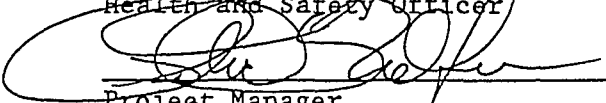
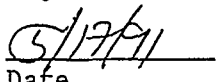
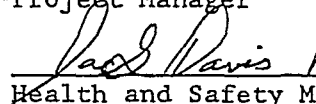
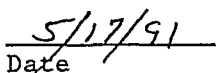
### CERTIFIED ABB ENVIRONMENTAL TEAM PERSONNEL:

<u>*+ Ken Busen</u>	<u>*+ Joe Daniels</u>
<u>*+ Peter Redfern</u>	<u>*+ Andrew Harvey</u>
<u>*+ Jay Koch</u>	<u>*+ Kathleen O'Neil</u>
<u>*+ Alan Stodghill</u>	<u>*+ Peggy Layne</u>
<u>*+ Kevin Warner</u>	

### OTHER CERTIFIED PERSONNEL:


\* FIRST-AID-TRAINED  
+ CPR-TRAINED

8.2 HEALTH AND SAFETY PLAN (HASP) APPROVALS. By their signatures, the undersigned certify that this HASP will be used for the protection of the health and safety of all persons entering this site.

 _____ Health and Safety Officer	 _____ Date
 _____ Project Manager	 _____ Date
 _____ Health and Safety Manager/Supervisor	 _____ Date

8.3 FIELD TEAM REVIEW. I have read and reviewed the health and safety information in the HASP. I understand the information and will comply with the requirements of the HASP.

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

SITE/PROJECT: \_\_\_\_\_

**8.4 MEDICAL DATA SHEET.** This Medical Data Sheet will be completed by all on-site personnel and kept in the Support Zone during site operations. It is not a substitute for the Medical Surveillance Program requirements consistent with the CLEAN HASP. This data sheet will accompany any personnel when medical assistance or transport to hospital facilities is required. If more space is required, use the back of this sheet.

Project: \_\_\_\_\_

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Home Telephone: Area Code (\_\_\_\_) \_\_\_\_\_

Age: \_\_\_\_\_ Height: \_\_\_\_\_ Weight: \_\_\_\_\_

In case of emergency, contact: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: Area Code (\_\_\_\_) \_\_\_\_\_

Do you wear contact lenses? Yes ( ) No ( )

Allergies: \_\_\_\_\_

List medication(s) taken regularly: \_\_\_\_\_

Particular sensitivities: \_\_\_\_\_

Previous/current medical conditions or exposures to hazardous chemicals:

\_\_\_\_\_

Name of Personal Physician: \_\_\_\_\_

Telephone: Area Code (\_\_\_\_) \_\_\_\_\_



## 8.5 EMERGENCY TELEPHONE NUMBERS.

Police Department	(803) 747-5711
Primary Hospital (U.S. Naval Hospital	(803) 743-5130
Alternate Hospital (Baker Hospital)	(803) 744-2110
Base Fire Department	(803) 744-4073
Off-site Emergency Services	(803) 744-4073
Poison Control Center	(800) 962-1253
National Response Center	(800) 424-8802
Regional USEPA Emergency Response	(800) 414-8802
Site HSO: <u>Alan Stodghill</u>	(904) 656-1293
General Site Supervisor: <u>Ken Busen</u>	(904) 656-1293
Project Manager: <u>Peter Redfern</u>	(904) 656-1293
ABB Environmental HSM: <u>C.E. Sundquist</u>	(207) 775-5401 x101

8.6 ROUTES TO EMERGENCY MEDICAL FACILITIES. The primary source of medical assistance for the site is:

U.S. Naval Hospital  
Charleston, South Carolina

DIRECTIONS TO PRIMARY: Take Rhett Ave. (Hwy 136) south to Park Circle. Turn right and drive around Circle until you reach Montague Ave. Go west on Montague Ave. until you reach Interstate 26. Take Interstate 26 south approximately 3.5 miles. Hospital is on the right side of the Interstate. See Figure 8-1.

The alternate source of medical assistance for the site is:

Baker Hospital  
Charleston, South Carolina

DIRECTIONS TO ALTERNATE: Take Rhett Ave. (Hwy. 136) south to Park Circle. Turn right and drive around circle until you reach Durant Ave. Go west on Durant Ave. until you reach Rivers Ave. Take Rivers Ave. south approximately 1.5 miles. Hospital is on the left side of Rivers Ave. See Figure 8-1.

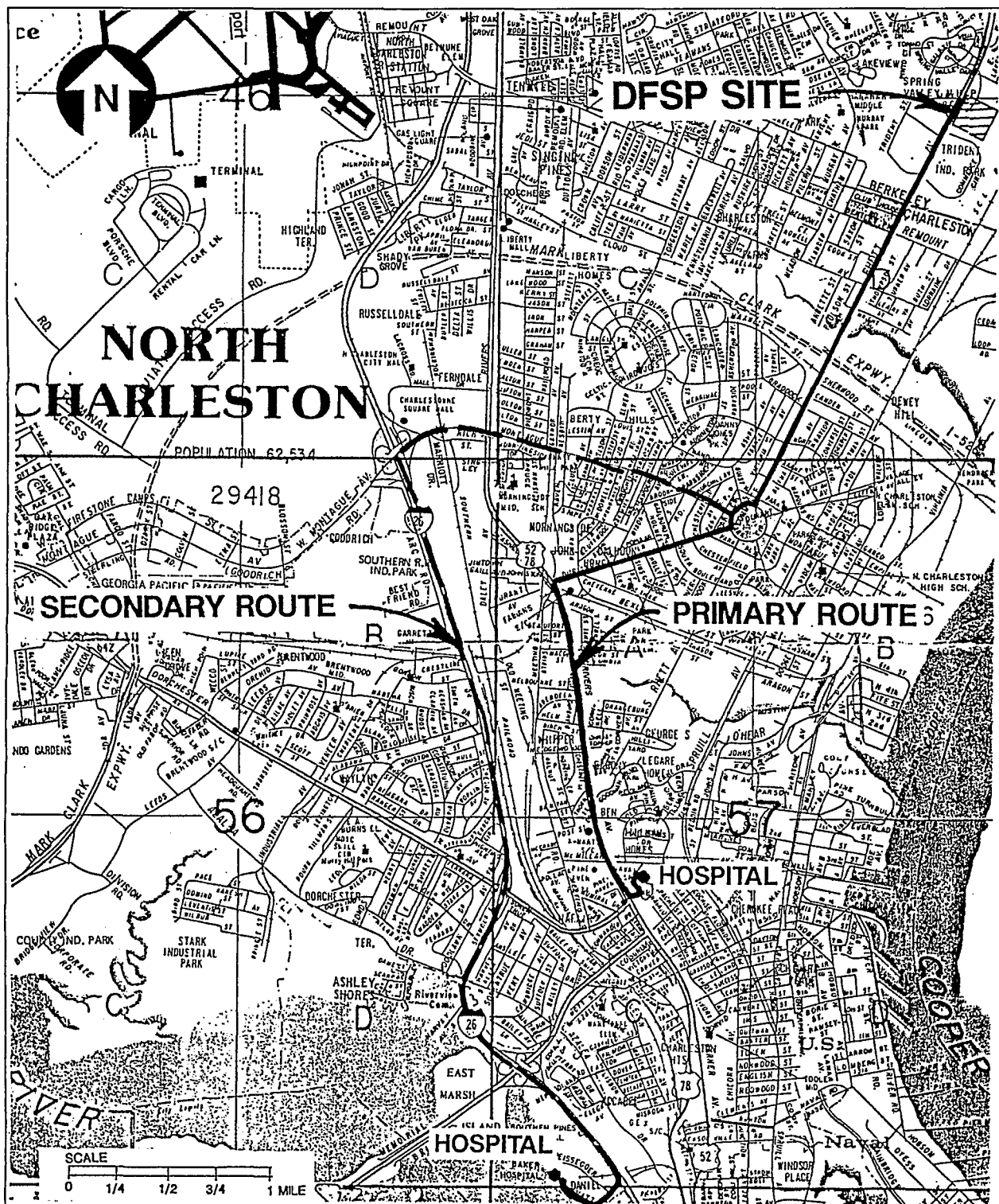


FIGURE 8-1

ROUTE TO U.S. NAVAL HOSPITAL  
AND BAKER HOSPITAL



SITE SPECIFIC  
HEALTH AND SAFETY PLAN

DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA

## JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

### Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

### Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

### Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

### Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides the employees may not be discharged or discriminated against in anyway for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discrimination.

### Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

### Proposed Penalty

The Act provides for mandatory penalties against employers of up to \$1,000 for each serious violation and for optional penalties of up to \$1,000 for each nonserious violation. Penalties of up to \$1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

### Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for health such as training.

### Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State labor or Health department or a State university.

### POSTING INSTRUCTIONS

Employees in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

### More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia	(404) 347-3573
Boston, Massachusetts	(617) 565-7164
Chicago, Illinois	(312) 353-2220
Dallas, Texas	(214) 767-4731
Denver, Colorado	(303) 844-3061
Kansas City, Missouri	(816) 426-5861
New York, New York	(212) 337-2325
Philadelphia, Pennsylvania	(215) 596-1201
San Francisco, California	(415) 995-5672
Seattle, Washington	(206) 442-5930

Washington, D.C.  
1989 (Revised)  
OSHA 2203

Elizabeth Dole, Secretary of Labor  
**U.S. Department of Labor**  
Occupational Safety and Health Administration

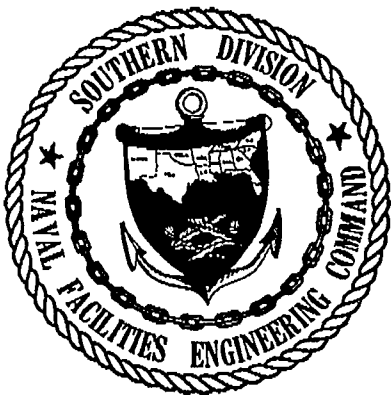
Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or a facsimile) in a conspicuous place where notices to employees are customarily posted.



# **FINAL DRAFT**

**MAY 1991  
CONTAMINATION ASSESSMENT PLAN  
HEALTH AND SAFETY PLAN**

**PLUME DELINEATION  
DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA**



**SOUTHERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
CHARLESTON, SOUTH CAROLINA  
29411-0068**



FINAL DRAFT

**CONTAMINATION ASSESSMENT PLAN**

**PLUME DELINEATION  
DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA**

**CTO NO.: 00010**

**CONTRACT NO. N62467-89-D-0317**

**Prepared by:**

**ABB Environmental Services, Inc.  
2571 Executive Center Circle East  
Tallahassee, FL 32301-5001**

**Prepared for:**

**Department of the Navy  
Southern Division  
Naval Facilities Engineering Command  
2155 Eagle Drive  
Charleston, South Carolina 29411-0068**

**Ted Campbell, Engineer-In-Charge**

**MAY 1991**

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### 1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES) was contracted by the Naval Facilities Engineering Command, Southern Division (SDIV) to prepare a Contamination Assessment Plan (CAP) for the Defense Fuel Supply Point (DFSP), Hanahan, South Carolina. The purpose of the CAP is to outline a field investigation and sampling program that will assess the source and extent of petroleum contamination along the eastern and western boundaries of the site. The investigation and subsequent report will be presented by SDIV to the South Carolina Department of Health and Environmental Control (SCDHEC) for review. The following report presents the site location, summarizes previous investigations, and develops the rationale for the proposed monitoring plan to be implemented under the Contamination Assessment (CA).

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### 2.0 BACKGROUND

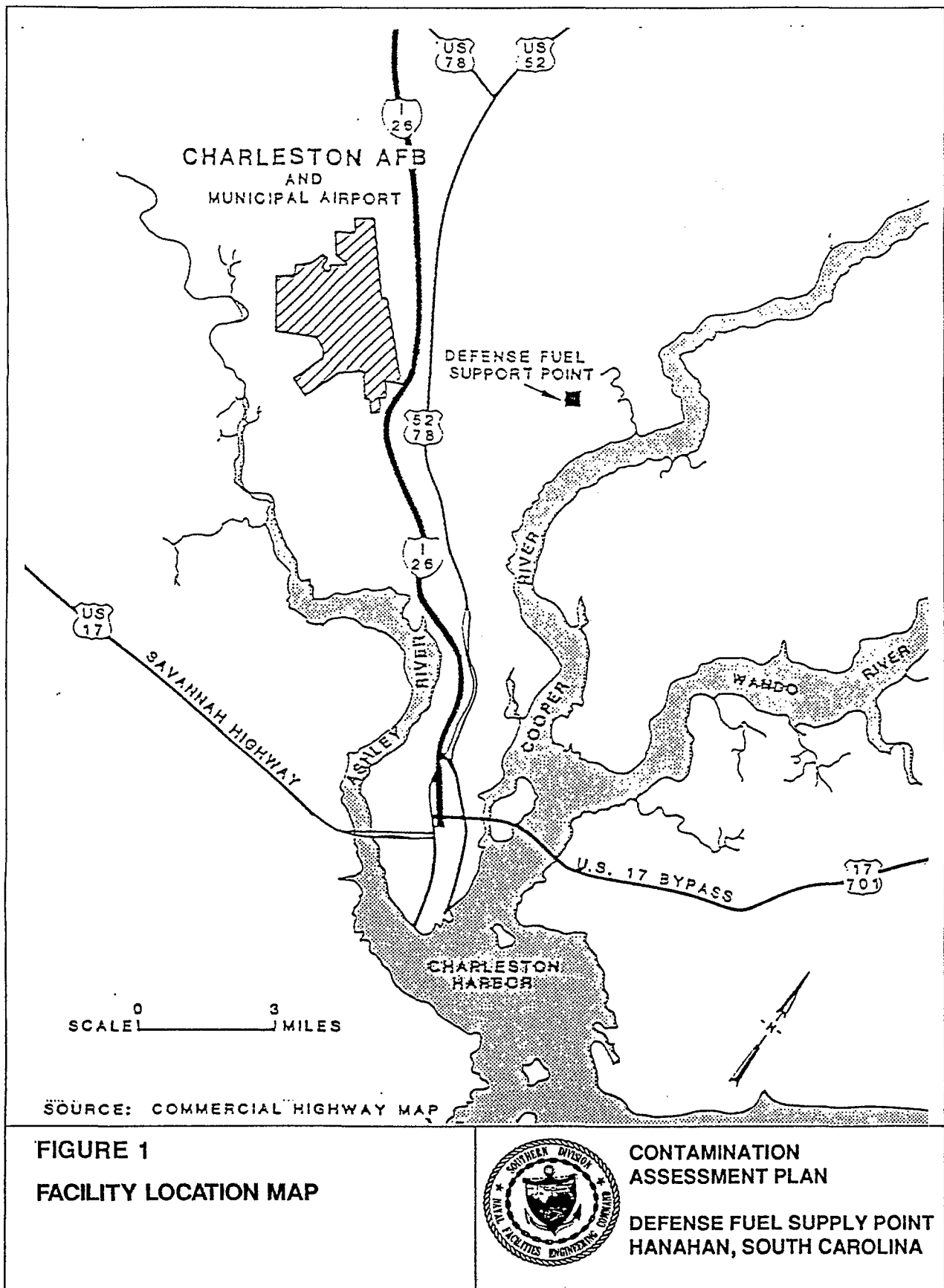
2.1 SITE DESCRIPTION. The DFSP site is located approximately 3.5 miles east of Charleston Air Force Base within the city limits of Hanahan, South Carolina (Figure 1). The site occupies approximately 36 acres just east of North Rhett Boulevard. Immediately north of the DFSP facility is a residential community called Gold Cup Springs Subdivision (Figure 2). The areas to the west and south of the site are comprised mainly of light industry. Immediately east of the site is a U.S. Army-Navy Reservation. The facility contains seven 70,000 barrel capacity aboveground storage tanks, truck loading stands, and several buildings. Each tank is constructed of welded steel with a floating roof and is surrounded by an earthen berm. The primary product handled at the facility is JP-4 jet turbine fuel.

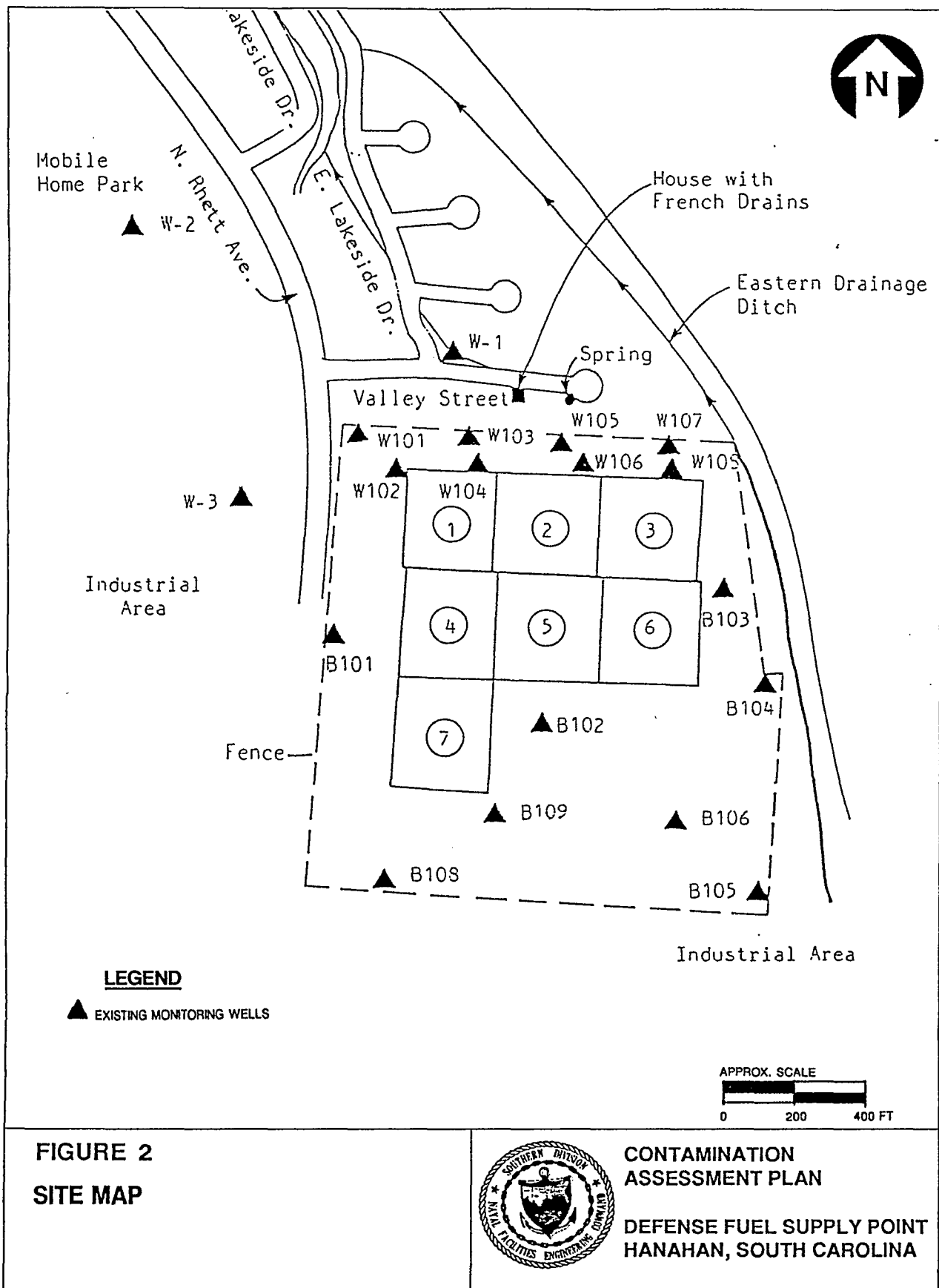
The DFSP facility is owned and operated by the Defense Logistics Agency, Alexandria, Virginia, and the facility property is owned by the U.S. Air Force. Environmental investigations and remedial activities at the site are being performed by SDIV.

2.2 SITE HISTORY. In September 1975, a leak developed in the bottom of storage tank No. 1 immediately after it had been cleaned and put back in service. Approximately 83,000 gallons of JP-4 jet fuel were lost before a water bottom was put in the tank. Leakage was confirmed to be the cause of the loss. The lost fuel reached the shallow, surficial aquifer and migrated northward into the Gold Cup Springs Subdivision, a subdivision of approximately 75 homes.

In November 1975, the U.S. Army Environmental Hygiene Agency (USAEHA) from Aberdeen Proving Ground, Maryland, was brought in to investigate the site. Monitoring wells were installed to delineate the contamination and a well point system was constructed in December 1975 to extract the fuel from the groundwater and soils. The well point system became impractical by January 1976. A collection ditch was built along the northern border of the site to collect the remaining fuel. A second well point system was installed in March 1976 and was operated until April 1976. It was estimated that approximately 25 percent of the lost fuel was recovered by these operations.

In June 1980, the Defense Fuel Support Center (DFSC) contracted Dames and Moore to conduct a field investigation and monitoring program to assess the extent of groundwater contamination at the DFSP facility and in the Gold Cup Springs Subdivision, north of the facility. Dames and Moore installed 17 monitoring wells and collected groundwater samples from these wells for pH, specific conductance, total organic carbon, oil and grease, and diethylene glycol monomethyl ether (a fuel system icing inhibitor) analyses. The study concluded that hydrocarbon-related contamination was present in minimal amounts and was dispersed around the site. Past fuel recovery, chemical and biological processes, and natural dilution had reduced groundwater contamination.





**FIGURE 2**  
**SITE MAP**



**CONTAMINATION  
ASSESSMENT PLAN**

**DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA**

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In 1985, samples from additional monitoring wells installed by Science Applications International Corporation and sampled by General Engineering Laboratories, revealed JP-4-related compounds, including benzene, ethyl benzene, toluene, and xylenes (BETX) in one of the off-site wells. In additional studies conducted by McClelland Engineers, Inc., in 1986 and RMT, Inc., in 1987, JP-4-related compounds were detected in the groundwater, surface water, soil, and sediment within the Gold Cup Springs Subdivision. In addition, air monitoring studies conducted by RMT, Inc., in 1987 identified some contamination of the air in subdivision homes and throughout the neighborhood.

In October 1987, ICF-Clements Associates, Inc., prepared a Risk Assessment for the DFSP facility. The results were that inhalation and ingestion of contamination associated with the facility, most notably benzene, could pose a potential cancer risk of greater than 1 in 1 million and that exposure to chemicals, while swimming in pools filled with contaminated groundwater, may result in significant risk. Exposure to noncarcinogens (most notably total xylenes) may also result in a hazard index greater than 1.

As a result of the investigations at the site, bioremediation was selected as the cleanup technique. The U.S. Geological Survey (USGS) is currently operating and monitoring the bioremediation system at the site.

In addition to the 83,000 gallon fuel leak at tank No. 1, other areas of the facility have been found to be contaminated with petroleum hydrocarbons. Small spills and leaks are the likely contributors of contamination in these areas. The USGS performed an initial site screening of the site using a passive soil gas survey in 1990. The USGS report concludes that an assessment of contamination delineation should be performed along the eastern and western parts of the facility.

### 2.3 HYDROGEOLOGY

2.3.1 Regional Hydrogeology The Charleston, South Carolina area is underlain by four water bearing zones. These zones include the surficial water table aquifer, the Tertiary Aquifer System, the Black Creek Aquifer, and the Middendorf Aquifer.

The Coastal Plain of South Carolina, which includes Charleston, consists of a series of complex, interbedded unconsolidated to partially consolidated sedimentary formations of Late Cretaceous to Quaternary age. Surficial sediments within the study area consist of a variable sequence of sand, silt, and clay with a basal conglomeratic layer containing phosphate nodules that are a part of the Ladson Formation. The formation averages about 30 feet in thickness. These sediments were deposited as a result of a series of sea level encroachments and recessions that occurred during the Pleistocene epoch (Siple, 1946.)

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The surficial water table aquifer is contained within the unconsolidated sediments of the Ladson Formation. The aquifer is recharged largely by the infiltration of precipitation over the area. Locally, the aquifer may be recharged by seepage from the underlying Santee Limestone in areas where the Cooper Formation is absent. Discharge from the surficial aquifer occurs principally by evapotranspiration and through natural seepage to surface water bodies. Shallow wells account for only a small amount of discharge from this aquifer and vertical migration into underlying aquifers is limited by the Cooper Formation. Depth to the water table of the surficial aquifer ranges from 3 to 15 feet below land surface (bls) and generally reflects changes in the local topography. Well yields average approximately 85 gallons per minute (gpm) with reported transmissivities between 600 and 1,340 feet squared per day ( $\text{ft}^2/\text{day}$ ) (Park, 1985). The groundwater is commonly acidic and may contain high iron concentrations.

Unconformably underlying the Ladson Formation and forming the lower confining unit of the surficial aquifer and upper confining unit of the Tertiary Aquifer System is the Cooper Formation of Oligocene age. The Cooper Formation is a massive sandy, phosphatic limestone that is uniform in color and texture. The Cooper Formation requires only a few feet of thickness to effectively retard vertical groundwater flow.

Underlying the Cooper Formation and comprising the Tertiary Aquifer System are the Santee Limestone of Eocene age and the Black Mingo Formation of Paleocene age. The Santee Limestone consists of a creamy-white to gray, slightly glauconitic lime mudstone to marl. The unit ranges from 60 to 80 feet thick in the project area (Park, 1985). Wells tapping this unit yield between 200 and 500 gpm and are mostly under artesian conditions. The Tertiary Aquifer System is recharged by infiltration in updip outcrop zones inland of the project area. Groundwater flow in the aquifer is to the southeast under relatively flat regional hydraulic gradients (Aucott and Speiran, 1985). Excessive hardness and high iron and fluoride concentrations are common in the groundwater of the Santee Limestone. Brackish water can be found at the coastal margin of Charleston County.

The Black Mingo Formation underlies the Santee Limestone and is composed of limestone, green to gray argillaceous sand, and dark-gray to black clay. This formation is approximately 400 feet thick in the project area (Park, 1985). This formation is hydraulically connected to the Santee Limestone and is the lowest unit of the Tertiary Aquifer System. The sands of the Black Mingo Formation constitute the major water-bearing strata. Well yields average approximately 230 gpm. Transmissivities in this unit range from 500 to 3,700  $\text{ft}^2/\text{day}$  and hydraulic conductivities range between 29 to 170  $\text{ft}/\text{day}$  (Park, 1985).

Underlying the Black Mingo Formation approximately 700 feet below mean sea level (MSL) are the Peedee, Black Creek, and Middendorf Formations of Late Cretaceous

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age. These formations consist of interbedded sand, silt, and clay with occasional limestone. Each of these formations is capable of producing groundwater under artesian pressure; however, the major water bearing zones are the Black Creek Aquifer in the Black Creek Formation and the Middendorf Aquifer in the Middendorf Formation.

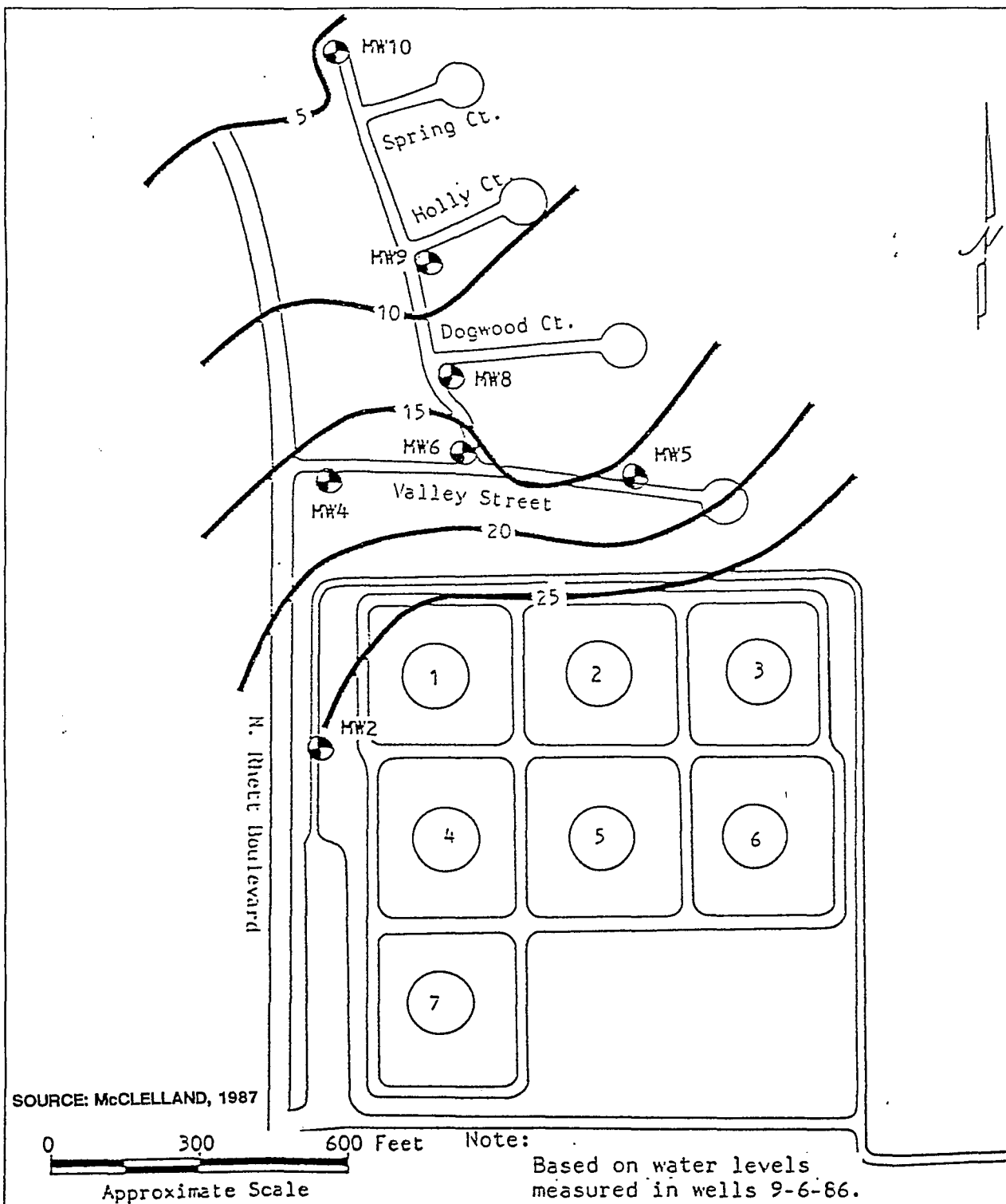
The lower part of the Black Mingo Formation and the Peedee Formation contain sufficient clays and silts to form an effective vertical hydraulic barrier between the upper Tertiary Aquifer System and the lower Black Creek Aquifer. Another confining unit exists in the lower Black Creek Formation and upper Middendorf Formation to separate the Black Creek Aquifer from the Middendorf Aquifer. Hydraulic conductivity in the Black Creek Aquifer has been estimated at 2 to 59 feet/day with a storage coefficient of  $10^{-4}$  (Park, 1985). Groundwater flow direction in the Black Creek Aquifer is to the east. The Middendorf Aquifer is the most productive of the two aquifers with groundwater flow to the east-northeast under a gentle regional hydraulic gradient (Aucott and Speiran, 1985). Both aquifers contain potable water; however, in some areas water quality may have excessive concentrations of dissolved sodium, bicarbonate, and fluoride.

The basement rock in the region is Triassic in age and occurs approximately 3,000 feet below MSL (Park, 1985).

2.3.2 Site Hydrogeology Soil boring and monitoring well data from previous studies indicate that the DFSP site is underlain by 25 to 38 feet of recent fill and fine sands with numerous clay and silt lenses and basal layers of phosphatic gravels of the Ladson Formation. This formation thins towards the north. The surficial aquifer is contained in these materials. Beneath the Ladson Formation and forming the base of the surficial aquifer is the homogeneous, dark green-gray calcareous clay and silt (marl) of the Cooper Formation. This formation is estimated to be 260 feet thick in this area and presents a very competent confining layer in the site area (Dames and Moore, 1982). The contact between the Ladson and Cooper Formations is undulatory and varies between 1 and 8 feet above MSL. Depth to the surficial aquifer water table ranged from 5 to 18 feet bls during previous investigations. Some of this variability is based on surface elevations; however, the data suggests that the water table fluctuated by as much as 7 feet at the site.

The general direction of groundwater flow in the surficial aquifer at the site is to the north-northwest. Localized groundwater flow directions at the site may be controlled by topography, with groundwater flow west of the DFSP site toward the west and groundwater flow just north of the DFSP site generally towards the centerline of the north-south valley through which East Lakeside Drive runs. Figure 3 illustrates a water table contour map from data collected on September 6, 1986. Calculations for hydraulic conductivity from monitoring wells at the site using the Hvorslev (1951) method range from  $10^{-4}$  to  $10^{-3}$  centimeters per second (cm/sec). An estimated seepage velocity at the DFSP site was calculated





**FIGURE 3**

**WATER TABLE CONTOUR MAP  
SEPTEMBER 6, 1986**



**CONTAMINATION  
ASSESSMENT PLAN**

**DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA**

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as  $8.5 \times 10^{-5}$  cm/sec or 0.24 feet per day using an average hydraulic conductivity of  $8.5 \times 10^{-4}$  cm/sec, an average hydraulic gradient of 0.02, and an effective porosity of 0.20 (McClelland Engineers, 1987). It is believed that the discharge of groundwater by the numerous springs in the Gold Cup Springs Lake neighborhood into the ditch on E. Lakeside Drive, along with the routing of groundwater discharges by French drains installed by several residents on Valley Street, may significantly increase the rate of contaminant transport.

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### 3.0 PROPOSED ASSESSMENT PLAN

It is proposed that a two-phase field investigation be undertaken to assess the suspected contaminant plumes along the eastern and western sides of the DFSP site. The phased approach is discussed in the following two sections. During both the Phase I and Phase II field investigations, the ABB-ES field leader will meet on-site or at SDIV with the SDIV Engineer-In-Charge (EIC) on a weekly basis to discuss the field investigation progress and findings.

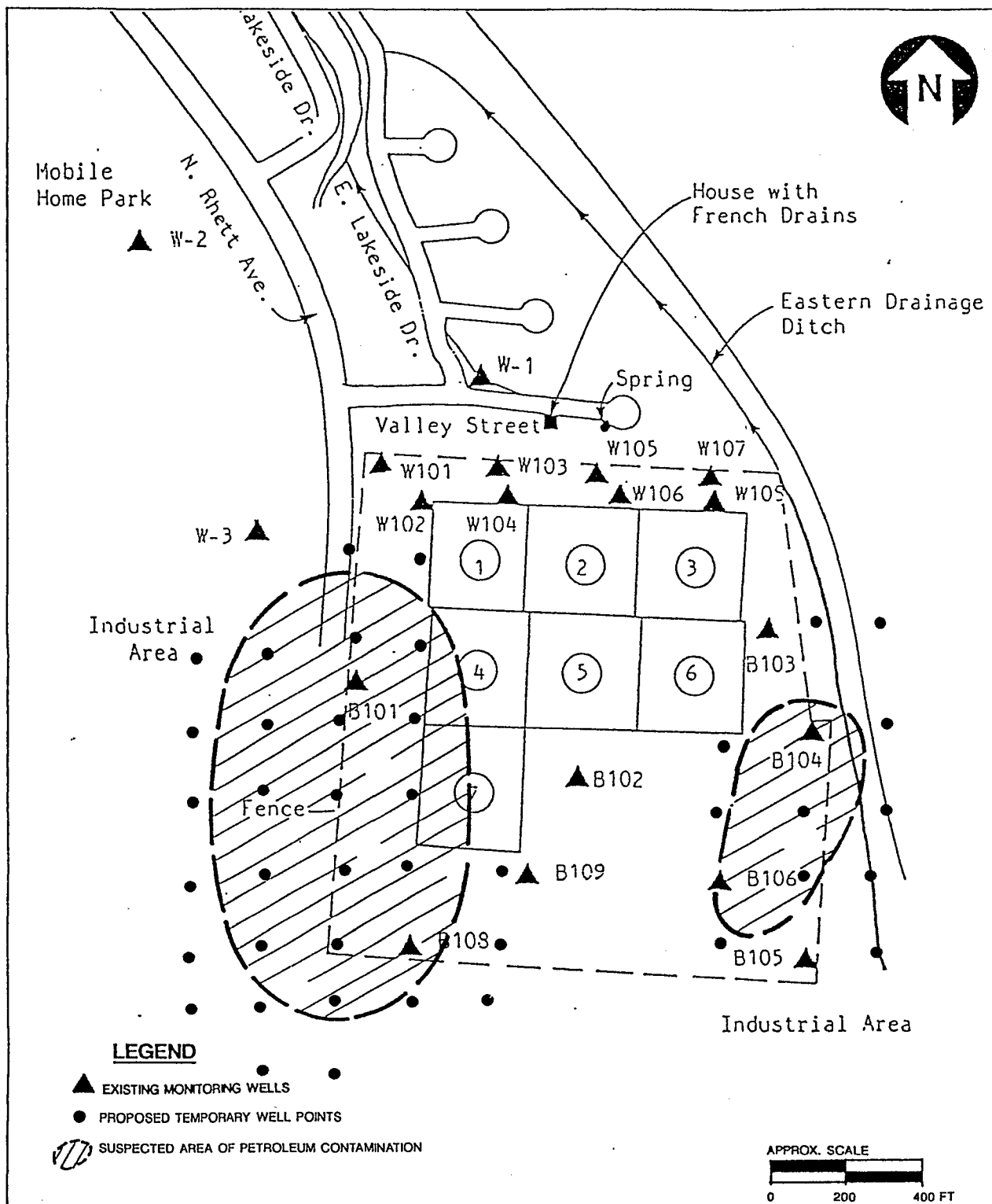
3.1 PHASE I FIELD INVESTIGATION. The purpose of the Phase I investigations is to assess the approximate horizontal extent of the contaminant plumes at the eastern and western sides of the site by obtaining groundwater samples from temporary wellpoints and soil samples from hand augered soil borings and screening these samples with a field gas chromatograph (groundwater) and organic vapor analyzer (soil). The information obtained during this field screening phase will assess the extent of the contaminant plumes and direct the placement of monitoring wells during the Phase II investigation.

Prior to the Phase I investigation, any necessary permits, off-site utility clearances, and right-of-way easements and private property access approvals will be obtained with the help of Navy personnel or their representatives. In addition, information on the location of potable water wells within a 1/4 mile radius of the site will be obtained from SDIV, DFSP, SCDHEC, and previous investigation reports.

The Phase I field investigation will consist of installing up to 40 temporary wellpoints along the western side of the DFSP site to assess the western contaminant plume. Up to 16 temporary wellpoints will be installed to assess the eastern contaminant plume. The locations of the proposed temporary wellpoints are shown on Figure 4. The wellpoints will be installed using a KV Macho System or equivalent.

Groundwater samples will be collected at each wellpoint location and screened for the presence of the petroleum contamination constituents benzene, ethyl benzene, toluene, and xylenes (BETX) using a field gas chromatograph (GC). In addition, up to 20 shallow soil borings will be conducted using a hand auger where possible at both the eastern and western contaminated areas to assess soil contamination and local lithology. Soils will be classified in accordance with the Unified Soil Classification System. Soil samples will be collected from each soil boring and placed in 16-ounce glass jars. The soil samples will be screened for petroleum contamination by head space analysis using an organic vapor analyzer (OVA) equipped with a flame ionization detector (FID).

3.2 PHASE II FIELD INVESTIGATION. The purpose of the Phase II field investigation is to further assess the horizontal extent of the petroleum contamination in the eastern and western areas of the DFSP facility, assess the vertical extent of the petroleum contamination, and characterize the contamination. This will be accomplished through the drilling of soil borings in areas where hand augering



**FIGURE 4**  
**PROPOSED WELL POINT LOCATIONS**



**CONTAMINATION  
 ASSESSMENT PLAN**

**DEFENSE FUEL SUPPLY POINT  
 HANAHAN, SOUTH CAROLINA**

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could not take place to collect soil samples for OVA screening; the installation of permanent groundwater monitoring wells; the collection of groundwater samples from the monitoring wells for laboratory analysis of jet fuel constituents; surveying of the elevations of the monitoring wells to determine aquifer flow direction and gradient; and aquifer testing on select monitoring wells to estimate aquifer characteristics.

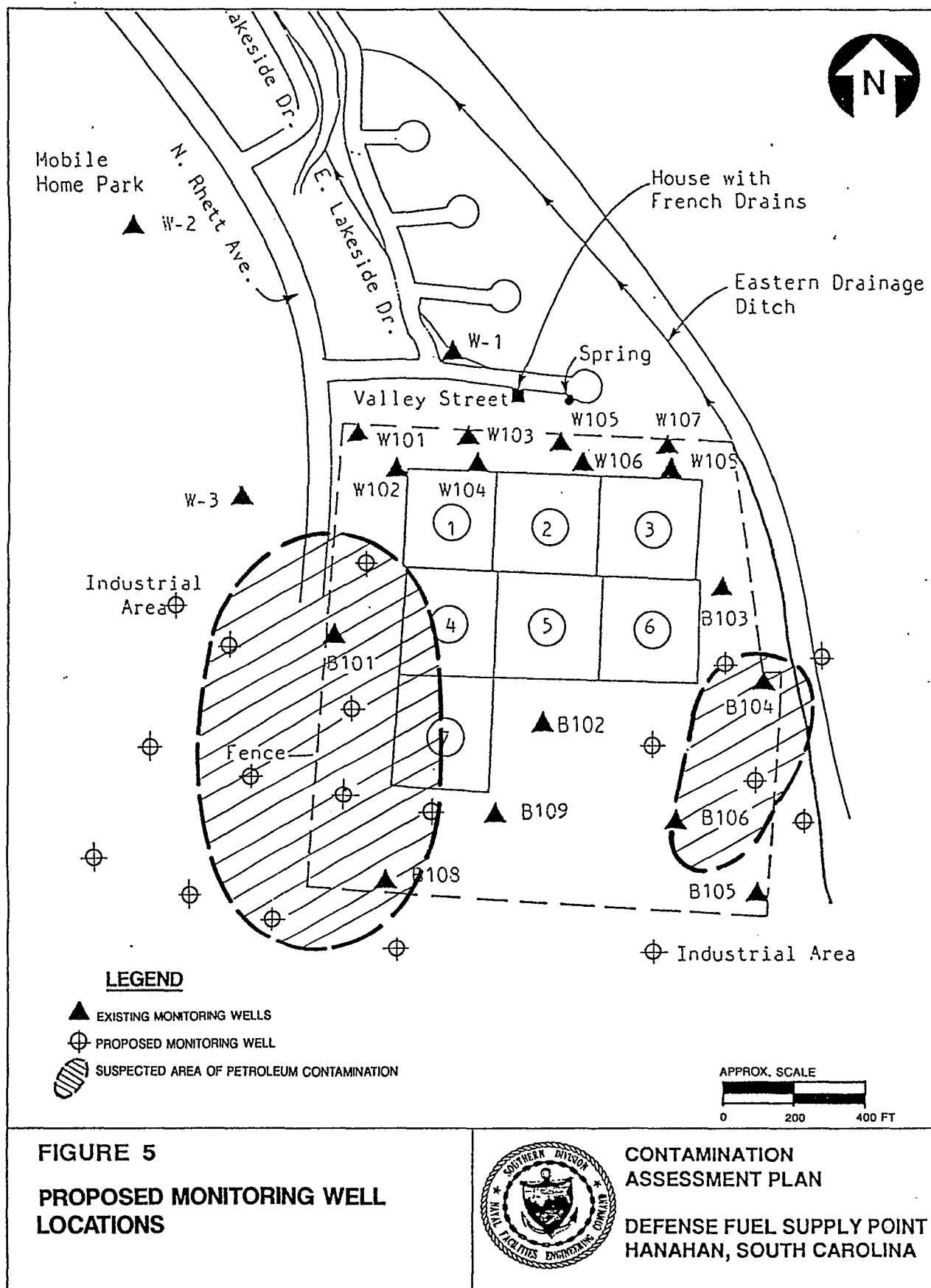
During the Phase II field investigation, 18 shallow monitoring wells (up to 15 feet in depth) will be installed at the site to assess the eastern and western contaminant plumes. The location of the proposed monitoring wells is shown on Figure 5; however, exact well placement will depend on the results of the Phase I investigation. All monitoring wells will be constructed of 2-inch inside diameter (ID), flush threaded Schedule 40 polyvinyl chloride (PVC) screen and riser. The well screen will be comprised of a 10 foot section of 0.010-inch slotted screen. Well screens will be set such that a minimum of 2 feet of screen will be above the water table. Depth to the water table in existing wells will be measured to determine the depth interval for the well screen. The remainder of the well casing will consist of solid riser pipe to the ground surface. Total well length and depth for the shallow monitoring wells is not expected to exceed 15 feet bls.

The well annulus will be filter packed with No. 6-20 sand or an acceptable grade of sand to at least 1 foot above the well screen. A 2-foot bentonite seal will be placed above the sand pack with the remaining annular space grouted to the surface. Wells will be flush mounted with the ground surface and will consist of a locking protective cap and a steel subsurface vault set in the pavement around each well riser pipe. Typical construction details for the proposed monitoring wells are provided in Figure 6.

In addition to the monitoring wells, up to 15 shallow soil borings will be advanced with a drill rig in those areas where it was not possible to perform the Phase I manual soil borings.

Upon completion of the monitoring well installation, the wells will be developed using a centrifugal pump until the groundwater is sediment free or as clear as the aquifer will allow in a reasonable amount of time. The measuring point for groundwater elevation on the PVC riser pipe and the land surface adjacent to each monitoring well will be surveyed to within  $\pm 0.01$  foot based on an arbitrary reference elevation of 50 feet.

Groundwater samples will be collected from the newly installed monitoring wells in addition to the 11 existing wells at the site and analyzed for jet fuel constituents (U.S. Environmental Protection Agency Methods (EPA) 602, 610, 239.2, and 418.1). At the western contamination area 16 groundwater samples will be collected and at the eastern area, 13 groundwater samples will be collected. In addition, three duplicate samples; two equipment blanks; one field blank; and five trip blanks will be obtained.



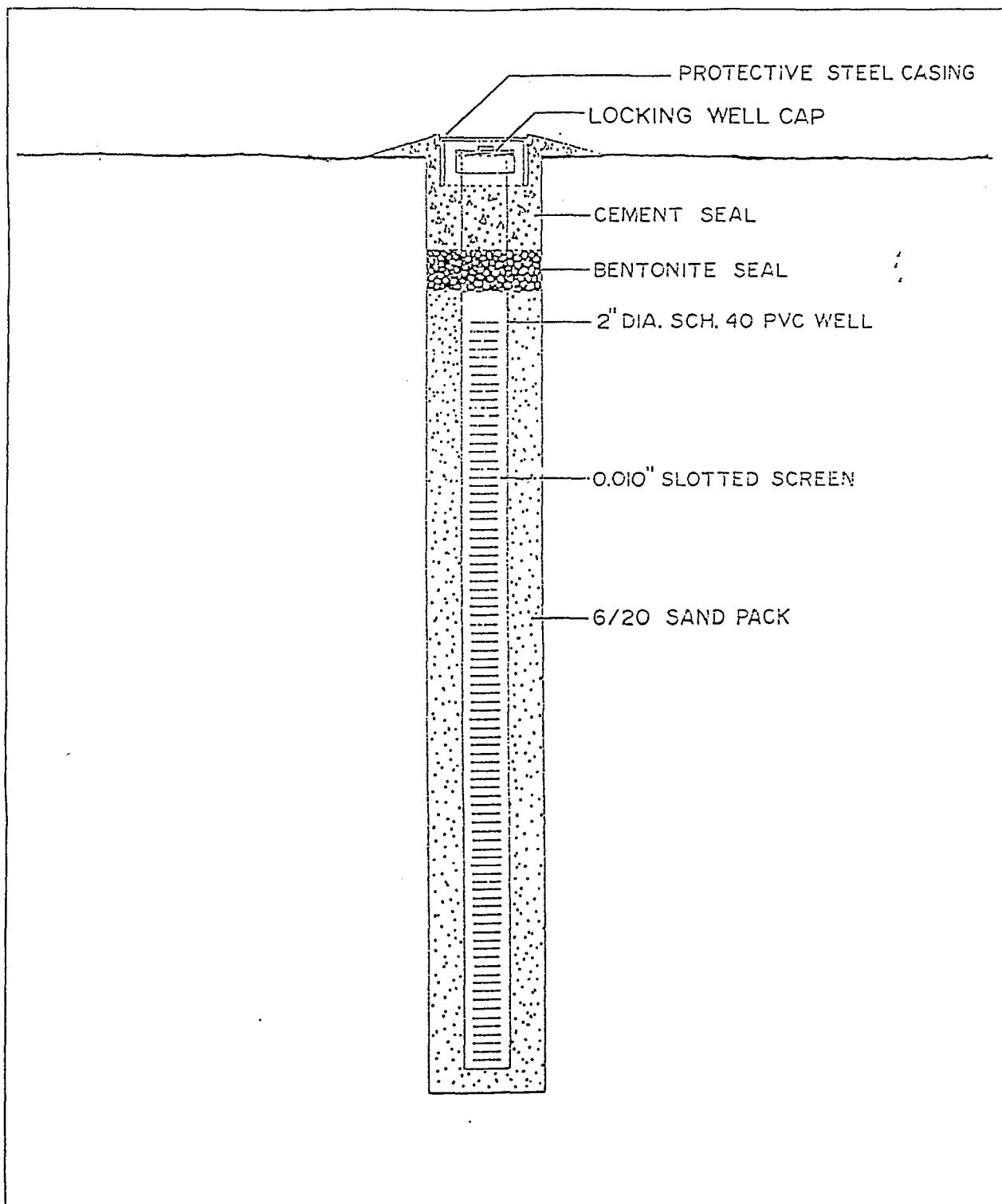


FIGURE 6

TYPICAL MONITORING WELL  
INSTALLATION DETAIL



CONTAMINATION  
ASSESSMENT PLAN

DEFENSE FUEL SUPPLY DEPOT  
HANAHAN, SOUTH CAROLINA

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Groundwater samples will be shipped via overnight carrier to an approved analytical laboratory. Sampling and the subsequent analytical program will comply with ABB-ES's Comprehensive Quality Assurance Plan (ComQAP).

During the Phase I and II field investigations, ABB-ES personnel and their subcontractors will coordinate efforts with site personnel to dispose of contaminated fluids and soils. ABB-ES and their subcontractors will place any contaminated soils on plastic sheeting in an area approved by the facility manager. The contaminated soil will be laid out in 6-inch deep layers and allowed to aerate and be exposed to sunlight. The soils will be covered with plastic sheeting in the event of a rainstorm. ABB-ES will till the soils every other day to accelerate the aeration process. Any contaminated fluids will be transported and deposited in a train tanker car that is kept at the facility for the purpose of disposal of waste fluids. It will be the Navy's responsibility to dispose of any hazardous waste that may be generated during this project.

3.3 PREPARATION OF REPORTS. Upon completion of the field investigations and receipt of the analytical laboratory results of the groundwater samples, draft, 100 percent complete, and final Contamination Assessment Reports (CARs) will be prepared and submitted to SDIV for review and approval. The reports will discuss site background information, site conditions, findings, and recommendations for the eastern and western areas of the DFSP site. Recommendations shall be made as to the need for any follow-up reports. Site location maps; locations of soil borings, wellpoints, and monitoring wells; groundwater contour maps; and contamination delineation maps will be included with the reports.

Based on the findings, conclusions, and recommendations of the final CAR, draft, 90 percent complete, 100 percent complete, and final follow-up reports will be prepared for the two areas of concern. The reports shall be either No Further Action Proposals (NOFAP), Monitoring Only Proposals (MOP), or Preliminary Remedial Action Plans (PRAP).

If a PRAP is developed for the DFSP site it will include the following items:

- summary sheet of the Contamination Assessment Report,
- general discussion of the technical and economic feasibility of the selected remedial system and why it was chosen over other remedial options,
- general discussion of the rationale of the selected system,
- comparison of contaminant levels found with existing State and EPA cleanup criteria in tabular format,
- disposition and expected contamination concentrations in any effluent from the proposed cleanup method,



## FINAL DRAFT

- cost estimates and schedules for the design phase, construction/-startup phase, and the operation phase,
- designation of monitoring wells and proposed methodology for verifying accomplishment of PRAP goals (cleanup levels),
- general discussion of the treatment of contaminated soils, and
- recommendations for conducting pilot studies and obtaining additional information.

The PRAPs will compare from two to four remedial technologies for cleanup of both groundwater and soil and the selected technology will be justified based on technical and economic feasibility. A conceptual design and rationale for the design will be provided for the selected remedial technology.

It is our understanding that Southern Division will develop performance specifications for construction that are based on the PRAP and the CAR. While these documents will provide some of the information necessary to develop performance specifications, neither document will be biddable. Additional site information that may be needed to develop the performance specifications but not included in this scope is as follows:

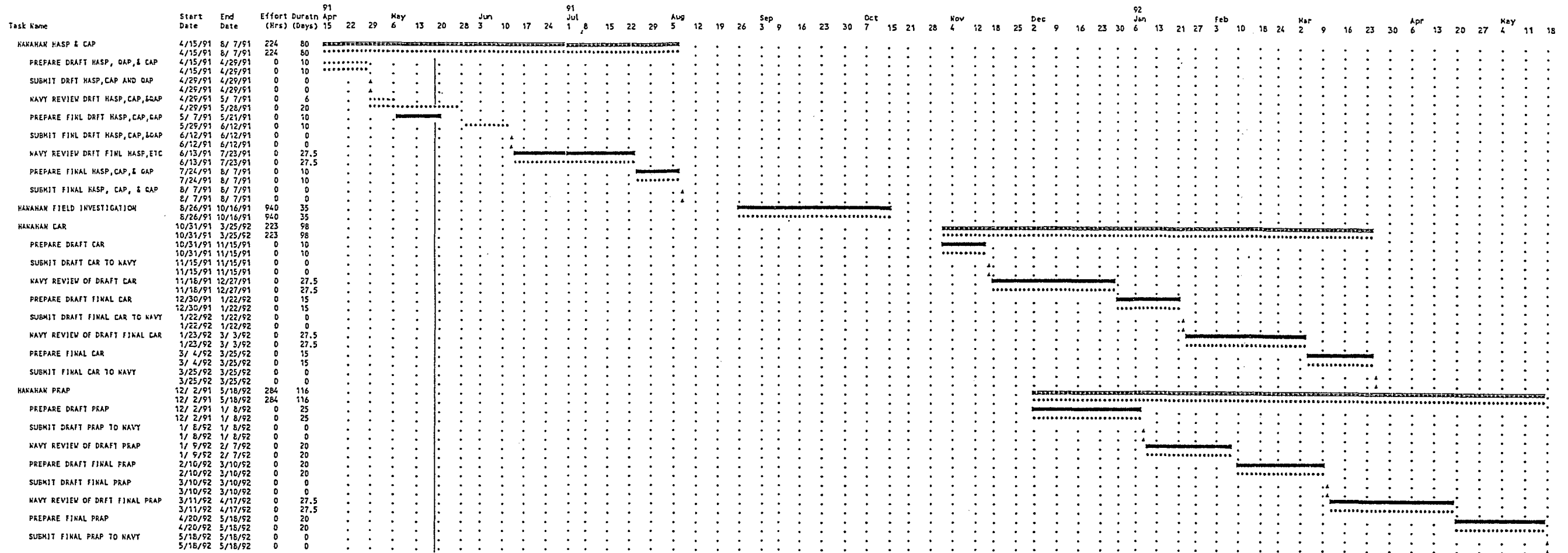
- horizontal and vertical survey data,
- locations of existing utilities, and
- location and availability amount of electric power.

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### 4.0 SCHEDULE

A projected schedule to complete the Contamination Assessment field investigation is approximately 7 weeks. The field investigation is tentatively scheduled to begin the week of August 26, 1991. Upon completion of the field investigation, approximately 3 weeks will be required before receipt of the laboratory analyses of the groundwater samples that were collected during the investigation. A draft Contamination Assessment Report will be prepared and submitted to SDIV by November 15, 1991. If proper time schedules for report review are followed, a draft follow-up report has been scheduled to be delivered to SDIV by January 8, 1992. A Gantt Chart outlining the project schedule is presented as Figure 7.

## SCHEDULE



### LEGEND











 Detail Task       Summary Task       Baseline  
 (Progress)       (Progress)       Conflict  
 (Slack)       (Slack)       Resource delay  
 Progress shows Percent Achieved on Actual       Milestone  
 Scale: 8 hours per character

FIGURE 7

## DFSP HANAHAN PROJECT GANTT CHART



**CONTAMINATION  
ASSESSMENT PLAN**

**DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA**

## FINAL DRAFT

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**SITE-SPECIFIC HEALTH AND SAFETY PLAN  
FOR  
CONTAMINATION ASSESSMENT INVESTIGATION**

**DEFENSE FUEL SUPPLY POINT  
HANAHA, SOUTH CAROLINA**

**CTO NO.: 00010**

**Contract Number N62467-89-D-0317**

**Prepared by:**

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**Prepared for:**

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Naval Facilities Engineering Command  
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**Ted Campbell, Engineer-In-Charge**

**MAY 1991**

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The following chapters of the Comprehensive Long-term Environmental Action Navy (CLEAN) Program District I Generic HASP are applicable for the work anticipated at the site:

- ☒ 2.0 AUTHORITY AND RESPONSIBILITY OF HEALTH AND SAFETY PERSONNEL
- ☒ 3.0 TRAINING PROGRAM
- ☒ 4.0 MEDICAL SURVEILLANCE PROGRAM
- ☒ 5.0 ENGINEERING CONTROLS
- ☒ 6.0 PERSONAL PROTECTIVE LEVEL DETERMINATION
- ☒ 7.0 MONITORING EQUIPMENT
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  - ☒ HEAT STRESS
  - ☐ COLD STRESS
- ☒ 13.0 DECONTAMINATION
- ☒ 14.0 EMERGENCY PLANNING
- ☒ 15.0 HEALTH AND SAFETY FORMS AND DATA SHEETS
  - ☐ HEALTH AND SAFETY AUDIT FORM
  - ☒ ACCIDENT REPORT FORM
  - ☒ HEALTH AND SAFETY OFFICER (HSO) CHECKLIST FOR FIELD OPERATIONS
  - ☒ MATERIAL SAFETY DATA SHEETS
  - ☐ LIQUI-NOX
  - ☐ ETHYL ALCOHOL (denatured)
  - ☐ TRISODIUM PHOSPHATE
  - ☒ OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) POSTER
  - ☒ DAILY HEALTH AND SAFETY AUDIT FORM

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- \_\_\_ 17.0     OTHER
  - \_\_\_     ILLUMINATION
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## 1.0 GENERAL

1.1 SCOPE AND PURPOSE. This Health and Safety Plan (HASP) has been prepared in conformance with the Navy CLEAN Program District I (CLEAN) HASP and is intended to meet the requirements of 29 Code of Federal Regulations (CFR) 1910.120. As such, the HASP addresses those activities associated with field operations for this project. Compliance with this HASP is required for all ABB-ES personnel, contractor personnel, or third parties entering the site.

### 1.2 PROJECT PERSONNEL.

1.2.1 Project Manager The project manager (PM) is the individual with overall project management responsibilities. Those responsibilities as they relate to health and safety include provision for the development of this site-specific HASP, the necessary resources to meet requirements of this HASP, the coordination of staff assignments to ensure that personnel assigned to the project meet medical and training requirements, and the means and materials necessary to resolve any health and safety issues that are identified or that develop on the project.

1.2.2 General Site Supervisor The General Site Supervisor is either the PM or the PM's designee who is on-site and vested with the authority by the PM to carry out day-to-day site operations, including interfacing with the site Health and Safety Officer (HSO).

1.2.3 Health and Safety Officer The HSO for this project has been designated by the PM with concurrence of the Health and Safety Supervisor (HSS) or Health and Safety Manager (HSM). The HSO will have at least an indirect line of reporting to the HSM through the HSS for the duration of his/her assignment as project HSO. The HSO is responsible for developing and implementing this site-specific HASP in accordance with the CLEAN HASP. The HSO will investigate all accidents, illnesses, and incidents occurring on-site. The HSO will also conduct safety briefings and site-specific training for on-site personnel. As necessary, the HSO will accompany all U.S. Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), or other governmental agency personnel visiting an ABB-ES site in response to health and safety issues. The HSO, in consultation with the HSS or HSM, is responsible for updating and modifying this HASP as site or environmental conditions change.

1.3 TRAINING. Training is defined under the CLEAN HASP, and all personnel entering potentially contaminated areas of this site must meet the requirements of 29 CFR 1910.120. Personnel without the required training will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 3.0 of the CLEAN HASP for further information.

1.4 MEDICAL SURVEILLANCE. All personnel entering potentially contaminated areas of this site will be medically qualified for site assignment through a medical surveillance program outlined in the CLEAN HASP. Personnel who have not received medical clearance will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 4.0 of the CLEAN HASP for further information.

## 2.0 SITE CHARACTERIZATION AND ANALYSIS

2.1 SITE NAME, LOCATION, AND SIZE. The Defense Fuel Supply Point (DFSP) site is located just east of North Rhett Boulevard approximately 3.5 miles east of Charleston Air Force Base within the city limits of Hanahan, South Carolina. The facility occupies approximately 48 acres.

2.2 SITE HISTORY AND LAYOUT. In September 1975, a leak developed in the bottom of one of seven 70,000 barrel capacity aboveground storage tanks. Approximately 83,000 gallons of JP-4 jet fuel was lost. The initial recovery operation recovered approximately 25 percent of the lost fuel. This leak occurred along the northern boundary of the property. Subsequent investigations from 1979 to 1990 indicated that petroleum contaminant plumes may exist along the eastern and western boundaries of the facility as a result of past spills and leaks.

2.3 SCOPE OF WORK (WORK PLAN). ABB-ES will conduct a contamination assessment along the eastern and western boundaries of the facility. The assessment will include shallow soil borings, collection of groundwater samples from temporary wellpoints, and the installation and sampling of permanent monitoring wells. The work will be conducted in Level D protective wear.

### 3.0 TASK ANALYSIS

#### 3.1 TASK ONE.

3.1.1 Hazardous Substances The contaminants of concern known or suspected to be present on-site, along with any established exposure limits for those substances are listed in Table 3-1.

3.1.2 Site Risks The following are the health hazards and safety hazards that are expected to be encountered at the site.

3.1.2.1 Health Hazards Contaminants to which personnel may be exposed are gasoline and diesel fuel and their constituents. The primary constituents of gasoline and diesel fuel that represent potential health hazards are described below and summarized in Table 3-1.

BENZENE is a watery, colorless liquid with a pleasant aromatic odor. It is a moderate irritant in small amounts both as a gas and as a liquid. If inhaled in large amounts it attacks the central nervous system, possibly resulting in coma and/or respiratory arrest. Chronic poisoning causes leukemia.

ETHYL BENZENE is a colorless aromatic liquid. It is a moderate skin irritant in gaseous form. Inhalation of high concentrations of the gas may cause temporary irritation of the nose, dizziness, and depression. The liquid form can blister the skin if not washed off immediately.

TOLUENE is a watery, colorless liquid with a pleasant aromatic odor. It is a mild skin irritant. Inhalation of high concentrations of the gas can cause temporary smarting of the eyes or irritation of the respiratory system. If the liquid form is allowed to remain on the skin for a long period of time, smarting and reddening of the skin may occur. Ingestion or aspiration of the liquid causes depressed respiration and pulmonary edema, and can result in kidney or liver damage.

XYLENE is a colorless, watery liquid with a sweet odor. It is a moderate skin irritant. When present as a gas in high concentrations, it can cause temporary slight smarting of the eyes or irritation of the respiratory system, headache, and dizziness. The liquid form may cause smarting or reddening of the skin if not washed off immediately. If the liquid is aspirated into the lungs it can result in severe coughing, distress, and rapidly developing pulmonary edema. If ingested, nausea, vomiting, cramps, headache, and coma can occur and may be fatal. Ingestion may also result in kidney and liver damage.

POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs), for the purposes of this plan and study, include those listed as parameters for USEPA Method 610. Some of the more notable PAHs from this method include acenaphthene, anthracene, chrysene, fluorene, naphthalene, phenanthrene, and pyrene.

**Table 3-1  
Contaminants of Concern**

Health and Safety Plan  
Defense Fuel Supply Point  
Hanahan, South Carolina

Chemical	Approximate odor threshold (ppm)	Permissible Exposure Limits (ppm)	Threshold Limit Value (ppm)	Physical Characteristics	Dermal Toxicity	Remarks
Benzene	4.7	1	1	Colorless liquid, pleasant aromatic odor.	Moderate skin irritant.	Inhalation of large amounts attacks central nervous system (CNS); chronic poisoning causes leukemia.
Ethyl benzene	140	100	100	Colorless liquid, aromatic odor.	Moderate skin irritant.	Liquid blisters skin, inhalation results in dizziness, depression.
Toluene	0.17	100	100	Colorless liquid, pleasant aromatic odor.	Mild skin irritant.	Ingestion or aspiration can cause pulmonary edema, depressed respiration.
Xylene	0.05	100	100	Colorless liquid, aromatic odor.	Moderate skin irritant.	Inhalation causes headache and dizziness; vapors irritate eyes; can be fatal if ingested.
Naphthalene	--	10	10	Colorless to brown solid with an odor of mothballs	Moderate skin irritant	Inhalation causes headache and confusion; vapors irritate eyes.
Lead	--	--	--	Soft, ductile, gray, metal, soluble in water containing a weak acid.	--	Lead poisoning may cause fatigue, anemia, abdominal pains, and neurological damage.

Notes: ppm = parts per million.

In addition, care will be taken to avoid contact with the base neutral compounds that include naphthalene, phenanthrene, fluorene, and anthracene. Details of these compounds are listed in Section 4.0.

All activities at this site will be conducted in unconfined areas. This will minimize the chances of exposure of on-site personnel to either high vapor concentrations or strong liquid concentrations of any of the substances described above.

**3.1.2.2 Safety Hazards** Safety hazards include those hazards which personnel may be exposed to that are unrelated to hazardous wastes. These include hazards such as heat stress, operation and presence around heavy equipment, lifting of objects, vehicle traffic, and snake bites. Extreme caution should be exhibited by all personnel while conducting work around drill rigs, backhoes, and other heavy equipment. During hot days, personnel should take time to drink fluids and cool off to avoid overheating and symptoms related to heat stress.

Lifting of heavy objects should be done with caution. Personnel should assist one another with moving heavy objects or use the appropriate equipment to accomplish these tasks. During all site activities, personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes.



Power substations, powerlines, underground utilities, and underground pipelines are to be avoided during drilling operations. Information on underground utilities and scheduling of the field work at the facility will be coordinated with Mr. Don Matthews, the Quality Assurance Supervisor at DFSP Hanahan.

3.1.2.3 Conclusions and Risk Assessment Based on all of the available information (nature of the work, potential onsite chemicals and their properties, exposure limits, etc.), hazards associated with conducting the described field work are considered to be low, assuming appropriate health and safety practices are maintained.

3.1.3 Protective Measures The following are the protective measures that will be used at the site.

3.1.3.1 Engineering Controls Whenever needed, engineering controls (i.e., fans to blow volatilized chemicals away from the work area) will be used.

3.1.3.2 Levels of Protection A level D work uniform will be used at the site. Level D Protection should only be used when the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.

3.1.4 Monitoring It is intended that real time monitoring instrumentation will be used to monitor the work environment in order to ensure the appropriate level of protection for the site team.

3.1.4.1 Air Sampling To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the site, and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site. Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

1. Foxboro Organic Vapor Analyzer Model 128 (OVA)

If the OVA detects a steady measurable quantity of organic vapors greater than 5 ppm (above background conditions) in the breathing zone, the field team will withdraw from the site until health and safety conditions at the site are reevaluated.

3.1.4.2 Personal Monitoring Personal monitoring will be undertaken to characterize the personal exposure of high risk employees to the hazardous substances they may encounter on-site. Personal monitoring will be conducted on a representative basis. Personnel who are represented by the sampling will be noted in field logs.

The following personal monitoring equipment will be used at the site. Refer to Chapter 7.0 of the CLEAN HASP for information on the maintenance and calibration of the equipment.

1. Thermoluminescent Dosimetry Body Badge

4.0 DATA SHEETS

Hanahan.HSP  
05.91 (CLEAN.01)

# BENZENE

BNZ

<b>Common Synonyms</b> Benzol Benzole	<b>Waterly liquid</b>  <b>Colorless</b>  <b>Gasoline-like odor</b>  Floats on water. Flammable, irritating vapor is produced. Freezing point is 42°F.
Avoid contact with liquid and vapor. Keep people away. Wear goggles and self-contained breathing apparatus. Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.	
<b>Fire</b>	<b>FLAMMABLE.</b> Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
<b>Exposure</b>	<b>CALL FOR MEDICAL AID.</b>  <b>VAPOR</b> Irritating to eyes, nose and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  <b>LIQUID</b> Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
<b>Water Pollution</b>	<b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.</b> May be dangerous if it enters water intakes.  Notify local health and wildlife officials. Notify operators of nearby water intakes.
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Restrict access	
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C <sub>6</sub> H <sub>6</sub> 3.3 IMO/UN Designation: 2.2/1114 3.4 DOT ID No.: 1114 3.5 CAS Registry No.: 71-43-2	
<b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3	
<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic, rather pleasant aromatic odor; characteristic odor	
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a hose mask; hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield; hydrocarbon-insoluble apron such as neoprene. 5.2 Symptoms Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death. 5.3 Treatment of Exposure: SKIN: flush with water followed by soap and water; remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician. IF breathing is irregular or stopped, start resuscitation, administer oxygen. 5.4 Threshold Limit Value: 10 ppm 5.5 Short Term Inhalation Limit: 75 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; LD <sub>50</sub> = 50 to 500 mg/kg 5.7 Late Toxicity: Leukemia 5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smearing and reddening of the skin. 5.10 Odor Threshold: 4.68 ppm 5.11 IDLH Value: 2,000 ppm	

<b>6. FIRE HAZARDS</b> 6.1 Flash Point: 12°F C.C. 6.2 Flammable Limits in Air: 1.3%-7.9% 6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back 6.7 Ignition Temperature: 1097°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 6.0 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available	<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-U-V-W																																				
<b>7. CHEMICAL REACTIVITY</b> 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 32	<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation: <table> <thead> <tr> <th>Category</th><th>Rating</th></tr> </thead> <tbody> <tr> <td>Fire</td><td>3</td></tr> <tr> <td>Health</td><td></td></tr> <tr> <td>Vapor Irritant</td><td>1</td></tr> <tr> <td>Liquid or Solid Irritant</td><td>1</td></tr> <tr> <td>Poisons</td><td>3</td></tr> <tr> <td>Water Pollution</td><td></td></tr> <tr> <td>Human Toxicity</td><td>3</td></tr> <tr> <td>Aquatic Toxicity</td><td>3</td></tr> <tr> <td>Aesthetic Effect</td><td>1</td></tr> <tr> <td>Reactivity</td><td></td></tr> <tr> <td>Other Chemicals</td><td>2</td></tr> <tr> <td>Water</td><td>1</td></tr> <tr> <td>Self Reaction</td><td>0</td></tr> </tbody> </table> 11.3 NFPA Hazard Classification: <table> <thead> <tr> <th>Category</th><th>Classification</th></tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td><td>2</td></tr> <tr> <td>Flammability (Red)</td><td>3</td></tr> <tr> <td>Reactivity (Yellow)</td><td>0</td></tr> </tbody> </table>	Category	Rating	Fire	3	Health		Vapor Irritant	1	Liquid or Solid Irritant	1	Poisons	3	Water Pollution		Human Toxicity	3	Aquatic Toxicity	3	Aesthetic Effect	1	Reactivity		Other Chemicals	2	Water	1	Self Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
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<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 5 ppm/6 hr/minnow/lethal/distilled water 20 ppm/24 hr/sunfish/TL <sub>50</sub> /tap water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 1.2 lb/lb, 10 days 8.4 Food Chain Concentration Potential: None	<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 78.11 12.3 Boiling Point at 1 atm: 176°F = 80.1°C = 353.3°K 12.4 Freezing Point: 42.0°F = 5.5°C = 278.7°K 12.5 Critical Temperature: 552.0°F = 288.9°C = 562.1°K 12.6 Critical Pressure: 710 psia = 48.3 atm = 4.89 MN/m <sup>2</sup> 12.7 Specific Gravity: 0.679 at 20°C (liquid) 12.8 Liquid Surface Tension: 26.8 dynes/cm = 0.0268 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 35.0 dynes/cm = 0.035 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: 2.7 12.11 Ratio of Specific Heats of Vapor (Gas): 1.061 12.12 Latent Heat of Vaporization: 169 Btu/lb = 84.1 cal/g = 3.54 X 10 <sup>3</sup> J/kg 12.13 Heat of Combustion: -17,460 Btu/lb = -9696 cal/g = -406.0 X 10 <sup>3</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 30.45 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 3.22 psia																																				
<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Industrial pure .....99+ % Thiophene-free .....99+ % Nitration .....99+ % Industrial 90% .....85+ % Reagent .....99+ % 9.2 Storage Temperature: Open 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum																																					
<b>NOTES</b>																																					

# ETHYLBENZENE

ETB

<b>Common Synonyms</b> Phenylethane EB	<b>Liquid</b> Colorless Sweet, gasoline-like odor  Floats on water. Flammable, irritating vapor is produced.
Avoid contact with liquid and vapor. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.	
<b>Fire</b>	<b>FLAMMABLE.</b> Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
<b>Exposure</b>	<b>CALL FOR MEDICAL AID</b>  <b>VAPOR</b> Irritating to eyes, nose and throat. If inhaled, will cause dizziness or difficult breathing. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  <b>LIQUID</b> Will burn skin and eyes. Harmful if swallowed. Wash exposed skin with plenty of water. Flush affected areas with plenty of water. IF IN EYES: hold eyes open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS: have victim drink water. DO NOT INDUCE VOMITING.
<b>Water Pollution</b>	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Mechanical containment Should be removed Chemical and physical treatment	<b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic hydrocarbon 3.2 Formula: $C_8H_{10}$ 3.3 IMO/UN Designation: 3.3/1175 3.4 DOT ID No.: 1175 3.5 CAS Registry No.: 100-41-4	<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Self-contained breathing apparatus; safety goggles. 5.2 Symptoms Following Exposure: Inhalation may cause irritation of nose, dizziness, depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters. 5.3 Treatment of Exposure: INHALATION: If ill effects occur, remove victim to fresh air, keep him warm and quiet, and get medical help promptly; if breathing stops, give artificial respiration. INGESTION: induce vomiting only upon physician's approval; material in lung may cause chemical pneumonitis. SKIN AND EYES: promptly flush with plenty of water (15 min. for eyes) and get medical attention; remove and wash contaminated clothing before reuse. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limit: 200 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 2; LD <sub>50</sub> = 0.5 to 5 g/kg (rat) 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure. 5.10 Odor Threshold: 140 ppm 5.11 IDLH Value: 2,000 ppm	

<b>6. FIRE HAZARDS</b> 6.1 Flash Point: 80°F O.C.; 59°F C.C. 6.2 Flammable Limits in Air: 1.0%-6.7% 6.3 Fire Extinguishing Agents: Foam (most effective), water fog, carbon dioxide or dry chemical. 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion: Products: Irritating vapors are generated when heated. 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to the source of ignition and flash back. 6.7 Ignition Temperature: 850°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: 5.6 mm/min. 6.10 Adiabatic Flame Temperature: Data Not Available  (Continued)	<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-U																																				
<b>7. CHEMICAL REACTIVITY</b> 7.1 Reactivity With Water: No reaction 7.2 Reactivity With Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data Not Available 7.8 Reactivity Group: 32	<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation: <table> <tr> <th>Category</th><th>Rating</th></tr> <tr> <td>Fire.....</td><td>3</td></tr> <tr> <td>Health.....</td><td></td></tr> <tr> <td>Vapor Irritant.....</td><td>2</td></tr> <tr> <td>Liquid or Solid Irritant.....</td><td>2</td></tr> <tr> <td>Poisons.....</td><td>2</td></tr> <tr> <td>Water Pollution.....</td><td></td></tr> <tr> <td>Human Toxicity.....</td><td>1</td></tr> <tr> <td>Aquatic Toxicity.....</td><td>3</td></tr> <tr> <td>Aesthetic Effect.....</td><td>2</td></tr> <tr> <td>Reactivity.....</td><td></td></tr> <tr> <td>Other Chemicals.....</td><td>1</td></tr> <tr> <td>Water.....</td><td>0</td></tr> <tr> <td>Self Reaction.....</td><td>0</td></tr> </table> 11.3 NFPA Hazard Classification: <table> <tr> <th>Category</th><th>Classification</th></tr> <tr> <td>Health Hazard (Blue).....</td><td>2</td></tr> <tr> <td>Flammability (Red).....</td><td>3</td></tr> <tr> <td>Reactivity (Yellow).....</td><td>0</td></tr> </table>	Category	Rating	Fire.....	3	Health.....		Vapor Irritant.....	2	Liquid or Solid Irritant.....	2	Poisons.....	2	Water Pollution.....		Human Toxicity.....	1	Aquatic Toxicity.....	3	Aesthetic Effect.....	2	Reactivity.....		Other Chemicals.....	1	Water.....	0	Self Reaction.....	0	Category	Classification	Health Hazard (Blue).....	2	Flammability (Red).....	3	Reactivity (Yellow).....	0
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<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 28 ppm/96 hr/bluegill/TL <sub>50</sub> /fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 2.8% (theor.), 5 days 8.4 Food Chain Concentration Potential: None	<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 106.17 12.3 Boiling Point at 1 atm: 277.2°F = 136.2°C = 408.4°K 12.4 Freezing Point: -139°F = -95°C = 178°K 12.5 Critical Temperature: 651.0°F = 343.9°C = 617.1°K 12.6 Critical Pressure: 523 psia = 35.6 atm = 3.61 MN/m <sup>2</sup> 12.7 Specific Gravity: 0.867 at 20°C (liquid) 12.8 Liquid Surface Tension: 29.2 dynes/cm = 0.0292 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 35.46 dynes/cm = 0.03546 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.071 12.12 Latent Heat of Vaporization: 144 Btu/lb = 80.1 cal/g = 3.35 X 10 <sup>5</sup> J/kg 12.13 Heat of Combustion: -17,780 Btu/lb = -8677 cal/g = -43.5 X 10 <sup>3</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data Not Available 12.26 Limiting Value: Data Not Available 12.27 Reid Vapor Pressure: 0.4 psia																																				
<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Research grade: 99.98%; pure grade: 99.5%; technical grade: 99.0% 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or pressure-vacuum																																					
<b>6. FIRE HAZARDS (Continued)</b> 6.11 Stoichiometric Air to Fuel Ratio: Data Not Available 6.12 Flame Temperature: Data Not Available																																					

# ETHYLENE DIBROMIDE

EDB

Common Synonyms 1, 2-Dibromoethane Ethylene bromide Bromofume sym-Dibromoethane Dow-fume 40, W-10, W-15, W-40 Glycol dibromide		Liquid	Colorless	Sweet odor
Sinks in water. Poisonous vapor is produced. Freezing point is 50°F.				
Stop discharge if possible. Keep people away. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.				
Fire	Not flammable. POISONOUS GASES ARE PRODUCED WHEN HEATED. Wear goggles, self-contained breathing apparatus, and rubber over-clothing (including gloves). Cool exposed containers with water.			
Exposure	CALL FOR MEDICAL AID.  VAPOR POISONOUS IF INHALED. Irritating to eyes, nose and throat. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  LIQUID POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED. Irritating to skin and eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.			
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.			
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Should be removed Chemical and physical treatment		2. LABEL 2.1 Category: None 2.2 Class: Not pertinent		
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: BrCH <sub>2</sub> CH <sub>2</sub> Br 3.3 IMO/UN Designation: 6.1/1605 3.4 DOT ID No.: 1605 3.5 CAS Registry No.: 106-93-4		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Mildly sweet; like chloroform		
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Canister type mask or self-contained air mask; neoprene gloves; chemical safety goggles. 5.2 Symptoms Following Exposure: Local inflammation, blisters and ulcers on skin; irritation in lungs and organic injury to liver and kidneys; may be absorbed through skin. 5.3 Treatment of Exposure: Remove from exposure. Remove contaminated clothing. Wash skin with soap and water. Flush eyes with plenty of water. Consult physician. 5.4 Threshold Limit Value: 2 ppm 5.5 Short Term Inhalation Limit: 50 ppm for 5 min. 5.6 Toxicity by Ingestion: Grade 3; LD <sub>50</sub> = 50 to 500 mg/kg 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: Data not available 5.11 IDLH Value: 400 ppm				

<div>6. FIRE HAZARDS</div> <div>6.1 Flash Point: Not flammable</div> <div>6.2 Flammable Limits in Air: Not flammable</div> <div>6.3 Fire Extinguishing Agents: Not pertinent</div> <div>6.4 Fire Extinguishing Agents Not to be Used: Not pertinent</div> <div>6.5 Special Hazards of Combustion Products: Decomposition gases are toxic and irritating.</div> <div>6.6 Behavior in Fire: Decomposes into toxic irritating gases. Reacts with hot metals such as aluminum and magnesium.</div> <div>6.7 Ignition Temperature: Not flammable</div> <div>6.8 Electrical Hazard: Not pertinent</div> <div>6.9 Burning Rate: Not flammable</div> <div>6.10 Adiabatic Flame Temperature: Data Not Available</div> <div>6.11 Stoichiometric Air to Fuel Ratio: Data Not Available</div> <div>6.12 Flame Temperature: Data Not Available</div>	<div>10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-X</div>																																				
<div>7. CHEMICAL REACTIVITY</div> <div>7.1 Reactivity With Water: No reaction</div> <div>7.2 Reactivity with Common Materials: No reaction</div> <div>7.3 Stability During Transport: Stable</div> <div>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</div> <div>7.5 Polymerization: Not pertinent</div> <div>7.6 Inhibitor of Polymerization: Not pertinent</div> <div>7.7 Molar Ratio (Reactant to Product): Data Not Available</div> <div>7.8 Reactivity Group: 35</div>	<div>11. HAZARD CLASSIFICATIONS</div> <div>11.1 Code of Federal Regulations: ORM-A</div> <div>11.2 NAS Hazard Rating for Bulk Water Transportation:<table><thead><tr><th>Category</th><th>Rating</th></tr></thead><tbody><tr><td>Fire.....</td><td>0</td></tr><tr><td>Health</td><td></td></tr><tr><td>Vapor Irritant.....</td><td>1</td></tr><tr><td>Liquid or Solid Irritant.....</td><td>1</td></tr><tr><td>Poisons.....</td><td>3</td></tr><tr><td>Water Pollution</td><td></td></tr><tr><td>Human Toxicity.....</td><td>3</td></tr><tr><td>Aquatic Toxicity.....</td><td>3</td></tr><tr><td>Aesthetic Effect.....</td><td>2</td></tr><tr><td>Reactivity</td><td></td></tr><tr><td>Other Chemicals.....</td><td>1</td></tr><tr><td>Water.....</td><td>0</td></tr><tr><td>Self Reaction.....</td><td>0</td></tr></tbody></table></div> <div>11.3 NFPA Hazard Classification:<table><thead><tr><th>Category</th><th>Classification</th></tr></thead><tbody><tr><td>Health Hazard (Blue).....</td><td>3</td></tr><tr><td>Flammability (Red).....</td><td>0</td></tr><tr><td>Reactivity (Yellow).....</td><td>0</td></tr></tbody></table></div>	Category	Rating	Fire.....	0	Health		Vapor Irritant.....	1	Liquid or Solid Irritant.....	1	Poisons.....	3	Water Pollution		Human Toxicity.....	3	Aquatic Toxicity.....	3	Aesthetic Effect.....	2	Reactivity		Other Chemicals.....	1	Water.....	0	Self Reaction.....	0	Category	Classification	Health Hazard (Blue).....	3	Flammability (Red).....	0	Reactivity (Yellow).....	0
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<div>8. WATER POLLUTION</div> <div>8.1 Aquatic Toxicity: 15 mg/l/48 hr/bluegill/fresh water</div> <div>8.2 Waterfowl Toxicity: Data not available</div> <div>8.3 Biological Oxygen Demand (BOD): Data not available</div> <div>8.4 Food Chain Concentration Potential: None</div>	<div>12. PHYSICAL AND CHEMICAL PROPERTIES</div> <div>12.1 Physical State at 15°C and 1 atm: Liquid</div> <div>12.2 Molecular Weight: 167.65</div> <div>12.3 Boiling Point at 1 atm: 266°F = 131°C = 404°K</div> <div>12.4 Freezing Point: 49.6°F = 9.8°C = 283.0°K</div> <div>12.5 Critical Temperature: Not pertinent</div> <div>12.6 Critical Pressure: Not pertinent</div> <div>12.7 Specific Gravity: 2.180 at 20°C (liquid)</div> <div>12.8 Liquid Surface Tension: 36.75 dynes/cm = 0.03675 N/m at 20°C</div> <div>12.9 Liquid Water Interfacial Tension: 36.54 dynes/cm = 0.03654 N/m at 20°C</div> <div>12.10 Vapor (Gas) Specific Gravity: Not pertinent</div> <div>12.11 Ratio of Specific Heats of Vapor (Gas): 1.109</div> <div>12.12 Latent Heat of Vaporization: 82.1 Btu/lb = 45.6 cal/g = 1.91 X 10<sup>4</sup> J/kg</div> <div>12.13 Heat of Combustion: Not pertinent</div> <div>12.14 Heat of Decomposition: Not pertinent</div> <div>12.15 Heat of Solution: Not pertinent</div> <div>12.16 Heat of Polymerization: Not pertinent</div> <div>12.25 Heat of Fusion: 13.79 cal/g</div> <div>12.26 Limiting Value: Data Not Available</div> <div>12.27 Reid Vapor Pressure: 0.4 psia</div>																																				
<div>9. SHIPPING INFORMATION</div> <div>9.1 Grades of Purity: Commercial</div> <div>9.2 Storage Temperature: Ambient</div> <div>9.3 Inert Atmosphere: No requirement</div> <div>9.4 Venting: Pressure-vacuum</div>																																					

NOTES

# TETRAETHYL LEAD

TEL

<b>Common Synonyms</b> TEL Lead tetraethyl		Oily liquid  Colorless, but generally dyed red  Fruity odor
		Sinks in water. Poisonous, flammable vapor is produced.
AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Stop discharge if possible. Call fire department. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.		
<b>Fire</b>	Combustible. <b>POISONOUS GASES ARE PRODUCED IN FIRE.</b> Containers may explode in fire. Vapor may explode if ignited in an enclosed area. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Combat fires from behind barrier or protected location. Flood discharge area with water. Extinguish with water, dry chemical, foam, or carbon dioxide. Cool exposed containers with water.	
<b>Exposure</b>	CALL FOR MEDICAL AID.  <b>VAPOR POISONOUS IF INHALED OR IF SKIN IS EXPOSED.</b> Irritating to eyes. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  <b>LIQUID POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.</b> Will burn eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.	
<b>Water Pollution</b>	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-poison, water contaminant Restrict access Should be removed Chemical and physical treatment		<b>2. LABEL</b> 2.1 Category: Poison 2.2 Class: 6
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Not listed 3.2 Formula: $Pb(C_2H_5)_4$ 3.3 IMO/UN Designation: 6.1/1649 3.4 DOT ID No.: 1649 3.5 CAS Registry No.: 78-00-2		<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Dyed red or other distinctive color. 4.3 Odor: Sweet
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Organic vapor type canister face mask for short periods; air line type for longer periods; neoprene-coated, liquid-proof gloves; protective goggles or face shield; white or light-colored clothing; rubber shoes or boots. 5.2 Symptoms Following Exposure: Increased urinary output of lead. If a large degree of absorption from inhalation or skin contact, may cause insomnia, excitability, delirium, coma and death. Do not confuse with inorganic lead. 5.3 Treatment of Exposure: Remove victim from contaminated area and consult physician immediately. INGESTION: induce vomiting. SKIN: wash immediately with kerosene or similar petroleum distillate followed by soap and water. 5.4 Threshold Limit Value: 0.1 mg/m <sup>3</sup> 5.5 Short Term Inhalation Limit: 0.15 mg Pb/m <sup>3</sup> for 30 min. 5.6 Toxicity by Ingestion: Oral rat LD <sub>50</sub> = 17 mg/kg 5.7 Late Toxicity: Lead poisoning 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure. 5.10 Odor Threshold: Data not available 5.11 IDLH Value: 40 mg/m <sup>3</sup>		

<b>6. FIRE HAZARDS</b> 6.1 Flash Point: 200°F C.C.; 185°F O.C. 6.2 Flammable Limits in Air: Data not available 6.3 Fire Extinguishing Agents: Water, foam, dry chemical, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Toxic gases are generated in fires. 6.6 Behavior in Fire: May explode in fires. 6.7 Ignition Temperature: Decomposes above 230°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Data not available 6.10 Adiabatic Flame Temperature: Data not available	<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-X-Y								
<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Poison, B 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: <table> <tr> <th>Category</th><th>Classification</th></tr> <tr> <td>Health Hazard (Blue)</td><td>3</td></tr> <tr> <td>Flammability (Red)</td><td>2</td></tr> <tr> <td>Reactivity (Yellow)</td><td>3</td></tr> </table>		Category	Classification	Health Hazard (Blue)	3	Flammability (Red)	2	Reactivity (Yellow)	3
Category	Classification								
Health Hazard (Blue)	3								
Flammability (Red)	2								
Reactivity (Yellow)	3								
(Continued)									
<b>7. CHEMICAL REACTIVITY</b> 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: Rust and some metals cause decomposition. 7.3 Stability During Transport: Stable below 230°F. At higher temperatures, may detonate or explode when confined. 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: Data not available	<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 325.44 12.3 Boiling Point at 1 atm: Decomposes 12.4 Freezing Point: -215°F = -137°C = 136°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.633 at 20°C (liquid) 12.8 Liquid Surface Tension: 26.5 dynes/cm = 0.0265 N/m at (est.) 25°C 12.9 Liquid Water Interfacial Tension: (est.) 40 dynes/cm = 0.04 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: (est.) -7,670 Btu/lb = -4,380 cal/g = -183 X 10 <sup>3</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available								
<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 0.20 mg/l/96 hr/bluegill/TL <sub>50</sub> /fresh water 8.2 Waterflow Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: Data not available									
<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Technical 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum									
<b>6. FIRE HAZARDS (Continued)</b> 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available									

# TOLUENE

TOL

<b>Common Synonyms</b> Toluol Methylbenzene Methylbenzol		<b>Watery liquid</b>  <b>Colorless</b>  <b>Pleasant odor</b>  Floats on water. Flammable, irritating vapor is produced.
Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to "knock down" vapor. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.		
<b>Fire</b>	<b>FLAMMABLE.</b> Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.	
<b>Exposure</b>	<b>CALL FOR MEDICAL AID.</b>  <b>VAPOR</b> Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing difficult, give oxygen.  <b>LIQUID</b> Irritating to skin and eyes. If swallowed, will cause nausea, vomiting or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. <b>DO NOT INDUCE VOMITING.</b>	
<b>Water Pollution</b>	Dangerous to aquatic life in high concentrations. Fouling to shoreline. May be dangerous if it enters water intakes.  Notify local health and wildlife officials. Notify operators of nearby water intakes.	
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Evacuate area		<b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: $C_6H_5CH_3$ 3.3 IMD/UN Designation: 2.2/1284 3.4 DOT ID No.: 1284 3.5 CAS Registry No.: 106-96-3		<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves. 5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration. 5.3 Treatment of Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limits: 600 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 2; LD <sub>50</sub> = 0.5 to 5 g/kg 5.7 Late Toxicity: Kidney and liver damage may follow ingestion. 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.17 ppm 5.11 IDLH Value: 2,000 ppm		

<b>6. FIRE HAZARDS</b> 6.1 Flash Point: 40°F C.C.; 55°F O.C. 6.2 Flammable Limits in Air: 1.27%-7% 6.3 Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires. 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 897°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 5.7 mm/min. 6.10 Adiabatic Flame Temperature: Data not available  (Continued)		<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-U
<b>7. CHEMICAL REACTIVITY</b> 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 32		<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire..... 3 Health..... Vapor Irritant..... 1 Liquid or Solid Irritant..... 1 Poisons..... 2 Water Pollution..... Human Toxicity..... 1 Aquatic Toxicity..... 3 Aesthetic Effect..... 2 Reactivity..... Other Chemicals..... 1 Water..... 0 Self Reaction..... 0 11.3 NFPA Hazard Classification: Category Classification Health Hazard (Blue)..... 2 Flammability (Red)..... 3 Reactivity (Yellow)..... 0
<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 1180 mg/l/96 hr/sunfish/TL <sub>50</sub> /fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0%, 5 days; 36% (theor), 6 days 8.4 Food Chain Concentration Potential: None		<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 92.14 12.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K 12.4 Freezing Point: -138°F = -95.0°C = 178.2°K 12.5 Critical Temperature: 605.4°F = 318.6°C = 591.8°K 12.6 Critical Pressure: 596.1 psia = 40.55 atm = 4,108 MN/m <sup>2</sup> 12.7 Specific Gravity: 0.867 at 20°C (liquid) 12.8 Liquid Surface Tension: 28.0 dynes/cm = 0.0280 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.089 12.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61 X 10 <sup>3</sup> J/kg 12.13 Heat of Combustion: -17,430 Btu/lb = -9566 cal/g = -405.5 X 10 <sup>3</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 17.17 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 1.1 psia
<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Research, reagent, nitration-all 99.8 + %; industrial: contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 90/120: less pure than industrial. 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or pressure-vacuum		<b>6. FIRE HAZARDS (Continued)</b> 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available



# m-XYLENE

MLM

Common Synonyms 3-Dimethylbenzene xylol		Watery liquid	Colorless	Sweet odor
Floats on water. Flammable, irritating vapor is produced.				
Stop discharge if possible. Keep people away. Call fire department. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.				
Fire	<b>FLAMMABLE</b> Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear self-contained breathing apparatus. Extinguish with foam, dry chemical, or carbon dioxide. Water may be ineffective or fire. Cool exposed containers with water.			
Exposure	<b>CALL FOR MEDICAL AID.</b> <b>VAPOR</b> Irritating to eyes, nose, and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. <b>LIQUID</b> Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. <b>DO NOT INDUCE VOMITING.</b>			
Water Pollution	<b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.</b> Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.			
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Evacuate area Should be removed Chemical and physical treatment		2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3		
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: m-C <sub>6</sub> H <sub>4</sub> (CH <sub>3</sub> ) <sub>2</sub> 3.3 IMO/UN Designation: 3.2/1307 3.4 DOT ID No.: 1307 3.5 CAS Registry No.: 106-26-3		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Like benzene; characteristic aromatic		
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots. 5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma; can be fatal. Kidney and liver damage can occur. 5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limits: 300 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; LD <sub>50</sub> = 50 to 500 g/kg 5.7 Late Toxicity: Kidney and liver damage. 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.05 ppm 5.11 IDLH Value: 10,000 ppm				

<div>6. FIRE HAZARDS</div> <div>6.1 Flash Point: 84°F C.C.</div> <div>6.2 Flammable Limits in Air: 1.1%-6.4%</div> <div>6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide</div> <div>6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.</div> <div>6.5 Special Hazards of Combustion Products: Not pertinent</div> <div>6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.</div> <div>6.7 Ignition Temperature: 986°F</div> <div>6.8 Electrical Hazard: Class I, Group D</div> <div>6.9 Burning Rate: 5.8 mm/min.</div> <div>6.10 Adiabatic Flame Temperature: Data not available</div> <div>6.11 Stoichiometric Air to Fuel Ratio: Data not available</div> <div>6.12 Flame Temperature: Data not available</div>	<div>10. HAZARD ASSESSMENT CODE</div> <div>(See Hazard Assessment Handbook)</div> <div>A-T-U</div>																																				
<div>7. CHEMICAL REACTIVITY</div> <div>7.1 Reactivity With Water: No reaction</div> <div>7.2 Reactivity with Common Materials: No reaction</div> <div>7.3 Stability During Transport: Stable</div> <div>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</div> <div>7.5 Polymerization: Not pertinent</div> <div>7.6 Inhibitor of Polymerization: Not pertinent</div> <div>7.7 Molar Ratio (Reactant to Product): Data not available</div> <div>7.8 Reactivity Group: 32</div>	<div>11. HAZARD CLASSIFICATIONS</div> <div>11.1 Code of Federal Regulations: Flammable liquid</div> <div>11.2 NAS Hazard Rating for Bulk Water Transportation:</div> <table><thead><tr><th>Category</th><th>Rating</th></tr></thead><tbody><tr><td>Fire.....</td><td>3</td></tr><tr><td>Health</td><td></td></tr><tr><td>Vapor Irritant.....</td><td>1</td></tr><tr><td>Liquid or Solid Irritant.....</td><td>1</td></tr><tr><td>Poisons.....</td><td>2</td></tr><tr><td>Water Pollution</td><td></td></tr><tr><td>Human Toxicity.....</td><td>1</td></tr><tr><td>Aquatic Toxicity.....</td><td>3</td></tr><tr><td>Aesthetic Effect.....</td><td>2</td></tr><tr><td>Reactivity</td><td></td></tr><tr><td>Other Chemicals.....</td><td>1</td></tr><tr><td>Water.....</td><td>0</td></tr><tr><td>Self Reaction.....</td><td>0</td></tr></tbody></table> <div>11.3 NFPA Hazard Classification:</div> <table><thead><tr><th>Category</th><th>Classification</th></tr></thead><tbody><tr><td>Health Hazard (Blue).....</td><td>2</td></tr><tr><td>Flammability (Red).....</td><td>3</td></tr><tr><td>Reactivity (Yellow).....</td><td>0</td></tr></tbody></table>	Category	Rating	Fire.....	3	Health		Vapor Irritant.....	1	Liquid or Solid Irritant.....	1	Poisons.....	2	Water Pollution		Human Toxicity.....	1	Aquatic Toxicity.....	3	Aesthetic Effect.....	2	Reactivity		Other Chemicals.....	1	Water.....	0	Self Reaction.....	0	Category	Classification	Health Hazard (Blue).....	2	Flammability (Red).....	3	Reactivity (Yellow).....	0
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<div>8. WATER POLLUTION</div> <div>8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL<sub>50</sub>/fresh water</div> <div>8.2 Waterfowl Toxicity: Data not available</div> <div>8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor.), 8 days</div> <div>8.4 Food Chain Concentration Potential: Data not available</div>	<div>12. PHYSICAL AND CHEMICAL PROPERTIES</div> <div>12.1 Physical State at 15°C and 1 atm: Liquid</div> <div>12.2 Molecular Weight: 106.16</div> <div>12.3 Boiling Point at 1 atm: 268.4°F = 131.9°C = 405.1°K</div> <div>12.4 Freezing Point: -54.2°F = -47.9°C = 225.3°K</div> <div>12.5 Critical Temperature: 650.6°F = 345.8°C = 617.0°K</div> <div>12.6 Critical Pressure: 513.6 atm = 34.95 psia = 3,540 MN/m<sup>2</sup></div> <div>12.7 Specific Gravity: 0.864 at 20°C (liquid)</div> <div>12.8 Liquid Surface Tension: 28.6 dynes/cm = 0.0286 N/m at 20°C</div> <div>12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0364 N/m at 30°C</div> <div>12.10 Vapor (Gas) Specific Gravity: Not pertinent</div> <div>12.11 Ratio of Specific Heats of Vapor (Gas): 1.071</div> <div>12.12 Latent Heat of Vaporization: 147 Btu/lb = 61.9 cal/g = 3.43 X 10<sup>4</sup> J/kg</div> <div>12.13 Heat of Combustion: -17,554 Btu/lb = -8752.4 cal/g = -406.31 X 10<sup>3</sup> J/kg</div> <div>12.14 Heat of Decomposition: Not pertinent</div> <div>12.15 Heat of Solution: Not pertinent</div> <div>12.16 Heat of Polymerization: Not pertinent</div> <div>12.25 Heat of Fusion: 26.01 cal/g</div> <div>12.26 Limiting Value: Data not available</div> <div>12.27 Reid Vapor Pressure: 0.34 psia</div>																																				
<div>9. SHIPPING INFORMATION</div> <div>9.1 Grades of Purity: Research: 99.99%; Pure: 99.9%; Technical: 99.2%</div> <div>9.2 Storage Temperature: Ambient</div> <div>9.3 Inert Atmosphere: No requirement</div> <div>9.4 Venting: Open (flame arrester) or pressure-vacuum</div>																																					
<div>NOTES</div>																																					

## Diesel Oil (fuel oil #2)

Physical and chemical description: flammable, slightly viscous brown liquid obtained from the distillation of crude petroleum. Diesel oil is a mixture of hydrocarbons, predominately unbranched alkanes of 10-16 carbon atoms with smaller amounts of aromatic and polynuclear aromatic hydrocarbons (PAH's). Diesel oil floats on water, having a specific gravity of less than 1.

Uses: fuel for trucks, ships, and trains.

Toxicity: Because of their water solubility and carcinogenicity, benzene and PAH's are the chemicals of health concern in diesel oil. Benzene, found in trace amounts in diesel oil, is known to cause leukemia, a cancer of the blood forming cells. PAH's as a class (1-10% in diesel) are considered to be carcinogenic to a number of animal species. Benzo(a)pyrene is one of the most commonly found and carcinogenic PAH. The alkanes of 10-16 carbon atoms, which make up the bulk of diesel oil, are of less concern due to their very low water solubility and low toxicity.

Concentration Guidelines and Standards: The maximum tolerable concentration for diesel oil in drinking water is 100 ug/l, due to organoleptic (taste and smell) considerations. The EPA Office of Drinking Water recommends that the short term concentrations of PAH's in drinking water not exceed 25 ug/l. This is the 7 day suggested no adverse response level (SNARL) and does not take into account the long term cancer risk. These concentrations should be tolerated only in emergency situations where no other higher quality water source is available.

## Naphthalene (C<sub>10</sub>H<sub>8</sub>)

Physical and Chemical Description: white crystalline solid with a characteristic "moth ball" odor. Naphthalene is more dense than water (sp. gr. 1.145) and has a solubility of 30,000 - 40,000 ug/l @ 25°C. It melts at 80°C but will sublime (volatilize from a solid) at room temperature. Naphthalene is considered a polynuclear aromatic hydrocarbon (PAH).

Uses: intermediate in dye production and formation of solvents, lubricants, and motor fuels. Used directly as a moth repellent.

Toxicity: Naphthalene may be absorbed by inhalation, ingestion or skin or eye contact. Chronic exposure can cause cataracts, kidney disease and red blood cell breakdown, especially in infants and individuals deficient in the enzyme G6PD. Naphthalene has been shown to be nonmutagenic and noncarcinogenic.

Classification: Hazardous Substance (EPA)

Hazardous Waste (EPA)

Priority Toxic Pollutant (EPA)

Persistence: Naphthalene can oxidize in the presence of light and air, 50% after 14 days in one study. Microbial degradation has also been demonstrated in the laboratory in solutions as concentrated as 3.3 ug/l. Little breakdown is expected, however, under the dark, anaerobic conditions characteristic of in-situ ground water.

Phenanthrene (C<sub>14</sub>H<sub>10</sub>)

Physical and Chemical Description: colorless, monoclinic crystals soluble in water, 1,000-1,300 ug/l @ 2.5°C, specific gravity = 1.179.

Phenanthrene is a PAH.

Uses: dyes, explosives, a natural constituent of coal tar and of diesel oil (0.35%).

Toxicity: Phenanthrene has been identified as a mild allergen and human dermal photosensitizer. Limited acute and chronic animal experiments show it to be of low to moderate toxicity.

Classification: none

Fluorene (C<sub>13</sub>H<sub>10</sub>)

Physical and Chemical Description: Combustible white solid having a density of 1.20 and a water solubility of 1980 ug/l.

Uses: Manufacture of dyestuffs.

Toxicity: Little specific information is available about the toxicity of fluorene but it is a polynuclear aromatic hydrocarbon (PAH), a group which contains known human carcinogens.

Classification: None

## 5.0 SITE CONTROL

5.1 ZONATION. Due to the nature of the work (multiple soil borings and well installations throughout the study area) and the properties of the potential chemicals found onsite, typical exclusion, contamination reduction, and support zones are not necessary or practical at all locations. Therefore, where appropriate, a "floating" exclusion zone in the perimeter of the sampling site will be established to eliminate access to the area by individuals not working on the project or involved in the assessment work. The perimeter will be at least 20 feet in radius and moved accordingly as the assessment points are moved.

5.2 COMMUNICATIONS. When radio communication is not used, the following air horn signals will be employed:

HELP	three short blasts	( . . . )
EVACUATION	three long blasts	( _ _ _ )
ALL CLEAR	alternating long and short blasts	( _ . _ . )

5.3 WORK PRACTICES. General work practices to be used during ABB-ES projects are described in Chapter 9.0 of the CLEAN HASP. Work at the site will be conducted according to these established protocol and guidelines for the safety and health of all involved. Specific work practices necessary for this project or those that are of significant concern are described as follows.

- Work and sampling will be conducted in Level D clothing and equipment.

## 6.0 DECONTAMINATION AND DISPOSAL

All personnel and/or equipment leaving contaminated areas of the site will be subject to decontamination, which will take place in the contamination reduction zone. General decontamination practices used during ABB-ES projects are described in Chapter 13.0 of the CLEAN HASP.

6.1 PERSONNEL DECONTAMINATION. All personnel leaving the study area are subject to decontamination (as necessary). The decontamination procedure required will be determined by the nature and level of contamination found at the sites. At a minimum, site personnel will remove loose soils from boots and clothing before leaving the site. More thorough decontamination procedures will be observed as dictated by site conditions. These procedures are described in Chapter 13.0 of the CLEAN HASP.

6.1.1 Small Equipment Decontamination Small equipment will be protected from contamination as much as possible by keeping the equipment covered when at the site and placing the equipment on plastic sheeting, not the ground. Sampling equipment used at the site will be used only once or will be field cleaned between samples with soapy water (Alconox), rinsed with clean water, rinsed with an approved Quality Assurance/Quality Control solvent, and final rinsed with organic free water.

6.1.2 Heavy Equipment Decontamination Drilling equipment will be protected from contamination as much as possible by placing the equipment on plastic sheeting, not the ground. The drill rig and associated drilling equipment will be cleaned with high pressure water or high pressure steam followed by a soap and water wash and rinse. Loose material will be removed by brush. The person performing this activity will be at the level of protection used during the field investigation.

6.2 COLLECTION AND DISPOSAL OF DECONTAMINATION PRODUCTS. All disposable protective gear, decontamination fluids (for both personnel and equipment), and other disposable materials will be disposed of at the site. Decontamination fluids (i.e., isopropanol [e.g., split spoons and groundwater sampling pump]) will be stored in amber glass bottles. Disposable materials (e.g., gloves and Tyveks™) will be bagged and disposed of properly.

## 7.0 EMERGENCY AND CONTINGENCY PLAN

This section identifies emergency and contingency planning that has been undertaken for operations at this site. Most sections of the HASP provide information that would be used under emergency conditions. General emergency planning information is addressed in Chapter 14.0 of the CLEAN HASP. The following subsections present site-specific emergency and contingency planning information.

7.1 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATIONS. The site HSO or the Health and Safety designee is the primary authority for directing operations at the site under emergency conditions. All communications both on- and off-site will be directed through the HSO or designee.

7.2 EVACUATION. Evacuation procedures at the site will follow those procedures discussed in Chapter 14.5 of the CLEAN HASP for upwind withdrawal, site evacuation, and evacuation of the surrounding area. Evacuation from the DFSP facility will be conducted with all personnel meeting at the main facility gate at the northwest corner of the site. Evacuation will proceed by travelling south (left) on North Rhett Boulevard, away from the site.

7.3 EMERGENCY MEDICAL TREATMENT AND FIRST AID. Any personnel injured on-site will be rendered first aid as appropriate and transported to competent medical facilities for further examination and/or treatment. The preferred method of transport would be through professional emergency transportation means; however, when this is not readily available or would result in excessive delay, other transport will be authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

## 8.0 ADMINISTRATION

8.1 PERSONNEL AUTHORIZED DOWNRANGE. Personnel authorized to participate in downrange activities at this site have been reviewed and certified for site operations by the Project Manager and the HSS. Certification involves the completion of appropriate training, a medical examination, and a review of this site-specific HASP. All persons entering the site must use the buddy system, and check in with the Site Manager and/or HSO before going downrange.

### CERTIFIED ABB ENVIRONMENTAL TEAM PERSONNEL:

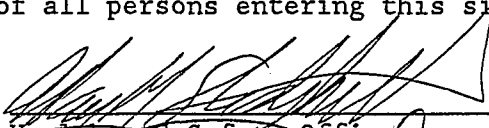
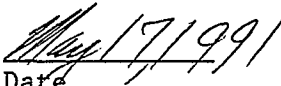

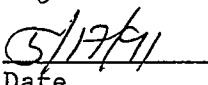
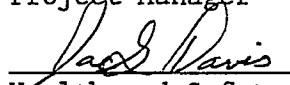
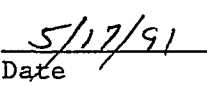
<u>*+ Ken Busen</u>	<u>*+ Joe Daniels</u>
<u>*+ Peter Redfern</u>	<u>*+ Andrew Harvey</u>
<u>*+ Jay Koch</u>	<u>*+ Kathleen O'Neil</u>
<u>*+ Alan Stodghill</u>	<u>*+ Peggy Layne</u>
<u>*+ Kevin Warner</u>	

### OTHER CERTIFIED PERSONNEL:


\* FIRST-AID-TRAINED  
+ CPR-TRAINED



8.2 HEALTH AND SAFETY PLAN (HASP) APPROVALS. By their signatures, the undersigned certify that this HASP will be used for the protection of the health and safety of all persons entering this site.

 _____ Health and Safety Officer	 _____ Date
 _____ Project Manager	 _____ Date
 _____ Health and Safety Manager/Supervisor	 _____ Date

8.3 FIELD TEAM REVIEW. I have read and reviewed the health and safety information in the HASP. I understand the information and will comply with the requirements of the HASP.

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

SITE/PROJECT: \_\_\_\_\_

8.4 MEDICAL DATA SHEET. This Medical Data Sheet will be completed by all on-site personnel and kept in the Support Zone during site operations. It is not a substitute for the Medical Surveillance Program requirements consistent with the CLEAN HASP. This data sheet will accompany any personnel when medical assistance or transport to hospital facilities is required. If more space is required, use the back of this sheet.

Project: \_\_\_\_\_

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Home Telephone: Area Code (\_\_\_\_) \_\_\_\_\_

Age: \_\_\_\_\_ Height: \_\_\_\_\_ Weight: \_\_\_\_\_

In case of emergency, contact: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: Area Code (\_\_\_\_) \_\_\_\_\_

Do you wear contact lenses? Yes ( ) No ( )

Allergies: \_\_\_\_\_

List medication(s) taken regularly: \_\_\_\_\_

Particular sensitivities: \_\_\_\_\_

Previous/current medical conditions or exposures to hazardous chemicals:

\_\_\_\_\_

Name of Personal Physician: \_\_\_\_\_

Telephone: Area Code (\_\_\_\_) \_\_\_\_\_

## 8.5 EMERGENCY TELEPHONE NUMBERS.

Police Department	(803) 747-5711
Primary Hospital (U.S. Naval Hospital	(803) 743-5130
Alternate Hospital (Baker Hospital)	(803) 744-2110
Base Fire Department	(803) 744-4073
Off-site Emergency Services	(803) 744-4073
Poison Control Center	(800) 962-1253
National Response Center	(800) 424-8802
Regional USEPA Emergency Response	(800) 414-8802
Site HSO: <u>Alan Stodghill</u>	(904) 656-1293
General Site Supervisor: <u>Ken Busen</u>	(904) 656-1293
Project Manager: <u>Peter Redfern</u>	(904) 656-1293
ABB Environmental HSM: <u>C.E. Sundquist</u>	(207) 775-5401 x101

8.6 ROUTES TO EMERGENCY MEDICAL FACILITIES. The primary source of medical assistance for the site is:

U.S. Naval Hospital  
Charleston, South Carolina

DIRECTIONS TO PRIMARY: Take Rhett Ave. (Hwy 136) south to Park Circle. Turn right and drive around Circle until you reach Montague Ave. Go west on Montague Ave. until you reach Interstate 26. Take Interstate 26 south approximately 3.5 miles. Hospital is on the right side of the Interstate. See Figure 8-1.

The alternate source of medical assistance for the site is:

Baker Hospital  
Charleston, South Carolina

DIRECTIONS TO ALTERNATE: Take Rhett Ave. (Hwy. 136) south to Park Circle. Turn right and drive around circle until you reach Durant Ave. Go west on Durant Ave. until you reach Rivers Ave. Take Rivers Ave. south approximately 1.5 miles. Hospital is on the left side of Rivers Ave. See Figure 8-1.

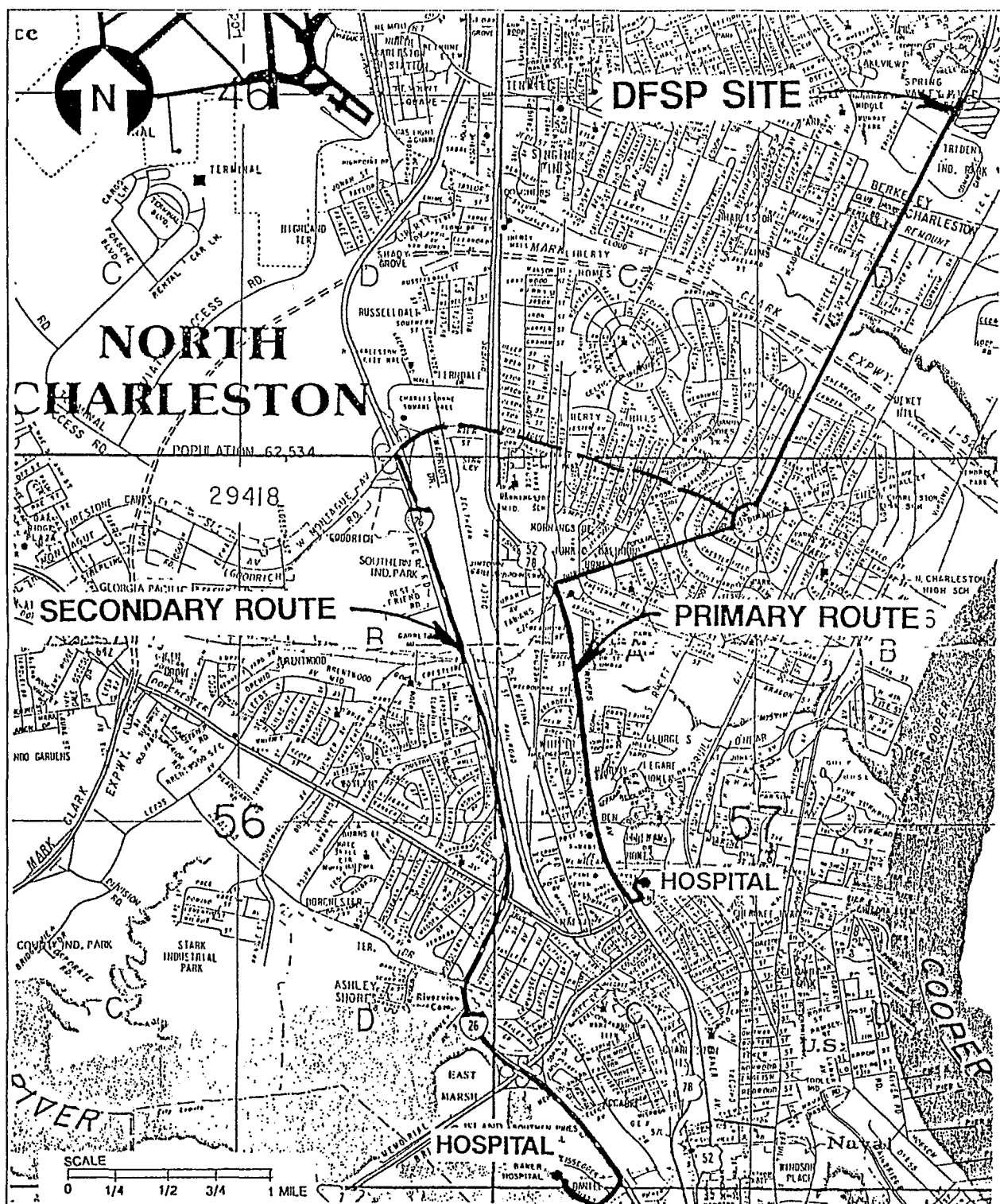


FIGURE 8-1

ROUTE TO U.S. NAVAL HOSPITAL  
AND BAKER HOSPITAL



SITE SPECIFIC  
HEALTH AND SAFETY PLAN

DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA

## JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

### Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm or employees. Employers must comply with occupational safety and health standards issued under the Act.

### Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

### Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

### Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides the employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discrimination.

### Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

### Proposed Penalty

The Act provides for mandatory penalties against employers of up to \$1,000 for each serious violation and for optional penalties of up to \$1,000 for each nonserious violation. Penalties of up to \$1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

### Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for health such as training.

### Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State labor or Health department or a State university.

### POSTING INSTRUCTIONS

Employees in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

### More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia	(404) 347-3573
Boston, Massachusetts	(617) 565-7164
Chicago, Illinois	(312) 353-2220
Dallas, Texas	(214) 767-4731
Denver, Colorado	(303) 844-3061
Kansas City, Missouri	(816) 426-5861
New York, New York	(212) 337-2325
Philadelphia, Pennsylvania	(215) 596-1201
San Francisco, California	(415) 995-5672
Seattle, Washington	(206) 442-5930

Washington, D.C.  
1989 (Revised)  
OSHA 2203

Elizabeth Dole, Secretary of Labor  
**U.S. Department of Labor**  
Occupational Safety and Health Administration

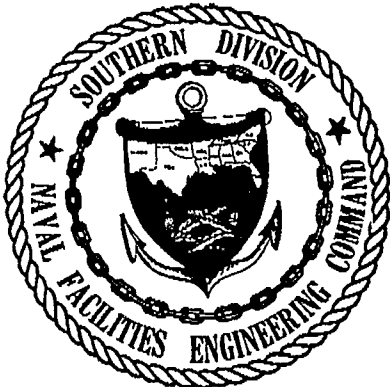
Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or a facsimile) in a conspicuous place where notices to employees are customarily posted.



# **DRAFT REPORT**

**APRIL 1991  
CONTAMINATION ASSESSMENT PLAN  
HEALTH AND SAFETY PLAN**

**PLUME DELINEATION  
DEFENSE FUEL SUPPLY DEPOT  
HANAHAN, SOUTH CAROLINA**



**SOUTHERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
CHARLESTON, SOUTH CAROLINA  
29411-0068**

DRAFT

**CONTAMINATION ASSESSMENT PLAN**

**PLUME DELINEATION  
DEFENSE FUEL SUPPLY POINT  
HANAHA, SOUTH CAROLINA**

**CTO NO.: 00015**

**CONTRACT NO. N62467-89-D-0317**

**Prepared by:**

**ABB Environmental Services, Inc.  
2571 Executive Center Circle East  
Tallahassee, FL 32301-5001**

**Prepared for:**

**Department of the Navy  
Southern Division  
Naval Facilities Engineering Command  
2155 Eagle Drive  
Charleston, South Carolina 29411-0068**

**Ted Campbell, Engineer-In-Charge**

**APRIL 1991**



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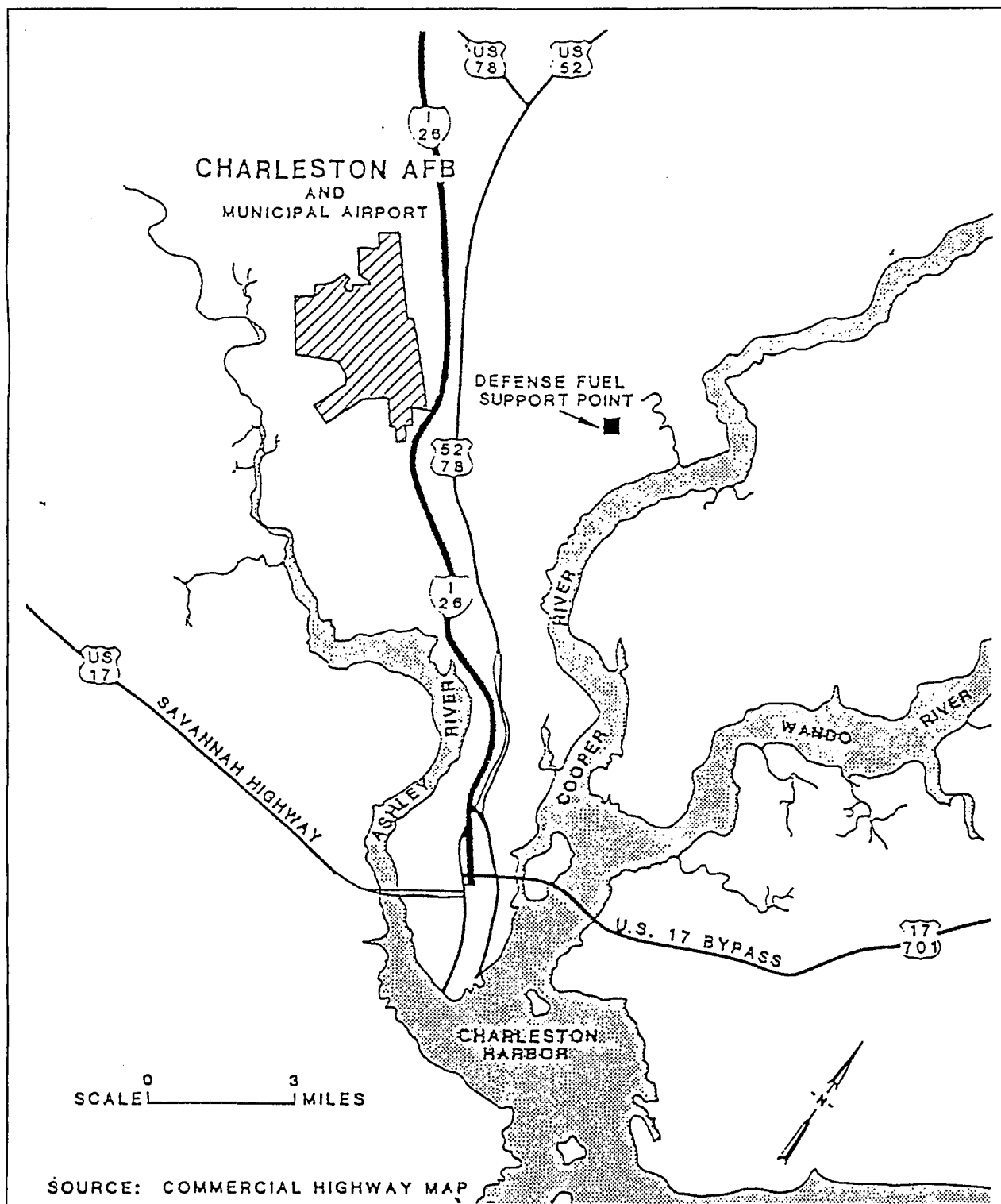
### 1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES) was contracted by the Naval Facilities Engineering Command, Southern Division (SDIV) to prepare a Contamination Assessment Plan (CAP) for the Defense Fuel Supply Point (DFSP), Hanahan, South Carolina. The purpose of the CAP is to outline a field investigation and sampling program which will assess the source and extent of petroleum contamination along the eastern and western boundaries of the site. The investigation and subsequent report will be presented by SDIV to the South Carolina Department of Health and Environmental Control (SCDHEC) for review. The following report presents the site location, summarizes previous investigations, and develops the rationale for the proposed monitoring plan to be implemented under the Contamination Assessment (CA).

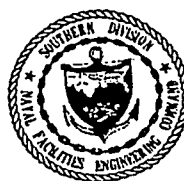
### 2.0 BACKGROUND

2.1 SITE DESCRIPTION. The DFSP site is located approximately 3.5 miles east of Charleston Air Force Base within the city limits of Hanahan, South Carolina (see Figure 1). The site occupies approximately 48 acres just east of North Rhett Boulevard. Immediately north of the DFSP facility is a residential community called Gold Cup Springs Subdivision (see Figure 2). The areas to the west and south of the site are comprised mainly of light industry. Immediately east of the site is a U.S. Army-Navy Reservation. The facility contains seven 70,000 barrel capacity above-ground storage tanks; truck loading stands; and several buildings. Each tank is constructed of welded steel with a floating roof and is surrounded by an earthen berm. The primary product handled at the facility is JP-4 jet turbine fuel.

The DFSP facility is owned and operated by the Defense Logistics Agency, Alexandria, Virginia, and the facility property is owned by the U.S. Air Force. Environmental investigations and remedial activities at the site are being performed by SDIV.

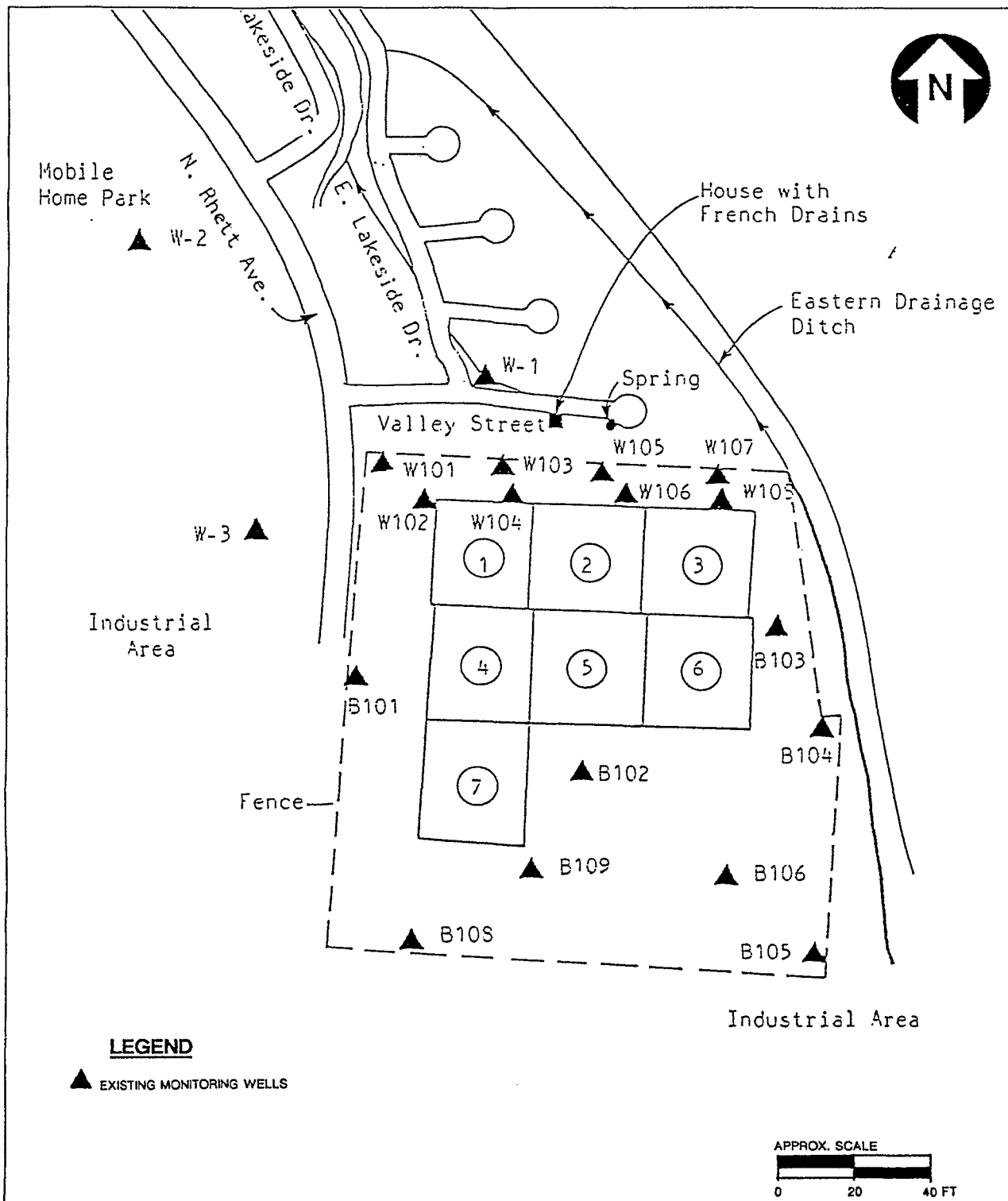


**FIGURE 1**  
**FACILITY LOCATION MAP**



**CONTAMINATION  
ASSESSMENT PLAN**

**DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA**



**FIGURE 2**  
**SITE MAP**



**CONTAMINATION  
ASSESSMENT PLAN**

**DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA**

## DRAFT

2.2 SITE HISTORY. In September 1975, a leak developed in the bottom of storage tank No. 1 immediately after it had been cleaned and put back in service. Approximately 83,000 gallons of JP-4 jet fuel were lost before a water bottom was put in the tank. Leakage was confirmed to be the cause of the loss. The lost fuel reached the shallow, surficial aquifer and migrated northward into the Gold Cup Springs Subdivision, a subdivision of approximately 75 homes.

In November 1975, the U.S. Army Environmental Hygiene Agency (USAEHA) from Aberdeen Proving Ground, Maryland was brought in to investigate the site. Monitoring wells were installed to delineate the contamination and a well point system was constructed in December 1975 to extract the fuel from the groundwater and soils. The well point system became impractical by January 1976. A collection ditch was built along the northern border of the site to collect the remaining fuel. A second well point system was installed in March 1976 and was operated until April 1976. It was estimated that approximately 25 percent of the lost fuel was recovered by these operations.

In June 1980, the Defense Fuel Support Center (DFSC) contracted Dames and Moore to conduct a field investigation and monitoring program to assess the extent of groundwater contamination at the DFSP facility and in the Gold Cup Springs Subdivision, north of the facility. Dames and Moore installed seventeen monitoring wells and collected groundwater samples from these wells for pH, specific conductance, total organic carbon, oil and grease, and diethylene glycol monomethyl ether (a fuel system icing inhibitor) analyses. The study concluded that hydrocarbon-related contamination was present in minimal amounts and was dispersed around the site. Past fuel recovery, chemical and biological processes, and natural dilution had reduced groundwater contamination.

In 1985, additional monitoring wells installed by Science Applications International Corporation and sampled by General Engineering Laboratories revealed JP-4 related compounds, including benzene, ethyl benzene, toluene, and xylenes (BETX) in one of the off-site wells. In additional studies conducted by

## DRAFT

McClelland Engineers, Inc., in 1986 and RMT, Inc., in 1987, JP-4 related compounds were detected in the groundwater, surface water, soil, and sediment within the Gold Cup Springs Subdivision. In addition, air monitoring studies conducted by RMT, Inc., in 1987 identified some contamination of the air in subdivision homes and throughout the neighborhood.

In October, 1987, ICF-Clements Associates, Inc. prepared a Risk Assessment for the DFSP facility. The results were that inhalation and ingestion of contamination associated with the facility, most notably benzene, could pose a potential cancer risk of greater than 1 in 1 million and that exposure to chemicals, while swimming in pools filled with contaminated groundwater, may result in significant risk. Exposure to noncarcinogens (most notably, total xylenes) may also result in a hazard index greater than 1.

As a result of the investigations at the site, bioremediation was selected as the cleanup technique. The United States Geological Survey (USGS) is currently operating and monitoring the bioremediation system at the site.

In addition to the 83,000 gallon fuel leak at tank No. 1, other areas of the facility have been found to be contaminated with petroleum hydrocarbons. Small spills and leaks are the likely contributors of contamination in these areas. The USGS performed an initial site screening of the site using a passive soil gas survey in 1990. The USGS report is currently under review by the SCDHEC and concludes that an assessment of contamination delineation should be performed along the eastern and western portions of the facility.

### 2.3 HYDROGEOLOGY

2.3.1 Regional Hydrogeology The Charleston, South Carolina area is underlain by four water bearing zones. These zones include the surficial water table aquifer, the Tertiary Aquifer System, the Black Creek Aquifer, and the Middendorf Aquifer.

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The Coastal Plain of South Carolina, that includes Charleston, consists of a series of complex interbedded unconsolidated to partially consolidated sedimentary formations of Late Cretaceous to Quaternary age. Surficial sediments within the study area consist of a variable sequence of sand, silt, and clay with a basal conglomeratic layer containing phosphate nodules that are a part of the Ladson Formation. The formation averages about 30 feet in thickness. These sediments were deposited as a result of a series of sea level encroachments and recessions which occurred during the Pleistocene epoch (Siple, 1946.)

Within the unconsolidated sediments of the Ladson Formation is contained the surficial water table aquifer. The aquifer is recharged largely by the infiltration of precipitation over the area. Locally, the aquifer may be recharged by seepage from the underlying Santee Limestone in areas where the Cooper Formation is absent. Discharge from the surficial aquifer occurs principally by evapotranspiration and through natural seepage to surface water bodies. Shallow wells account for only a small amount of discharge from this aquifer and vertical migration into underlying aquifers is limited by the Cooper Formation. Depth to the water table of the surficial aquifer ranges from 3 to 15 feet below land surface (bls) and generally reflects changes in the local topography. Well yields average approximately 85 gallons per minute (gpm) with reported transmissivities between 600 and 1,340 ft<sup>2</sup>/day (Park, 1985). The groundwater is commonly acidic and may contain high iron concentrations.

Unconformably underlying the Ladson Formation and forming the lower confining unit of the surficial aquifer and upper confining unit of the Tertiary Aquifer System is the Cooper Formation of Oligocene age. The Cooper Formation is a massive sandy, phosphatic limestone that is uniform in color and texture. The Cooper Formation requires only a few feet of thickness to effectively retard vertical groundwater flow.

Underlying the Cooper Formation and comprising the Tertiary Aquifer System are the Santee Limestone of Eocene age and the Black Mingo Formation of Paleocene



## DRAFT

age. The Santee Limestone consists of a creamy-white to gray, slightly glauconitic lime mudstone to marl. The unit ranges from 60 to 80 feet thick in the project area (Park, 1985). Wells tapping this unit yield between 200 and 500 gpm and are mostly under artesian conditions. The Tertiary Aquifer System is recharged by infiltration in updip outcrop zones inland of the project area. Groundwater flow in the aquifer is to the southeast under relatively flat regional hydraulic gradients (Aucott and Speiran, 1985). Excessive hardness and high iron and fluoride concentrations are common in the groundwater of the Santee Limestone. Brackish water can be found at the coastal margin of Charleston County.

The Black Mingo Formation underlies the Santee Limestone and is composed of limestone, green to gray argillaceous sand, and dark-gray to black clay. This formation is approximately 400 feet thick in the project area (Park, 1985). This formation is hydraulically connected to the Santee Limestone and is the lowest unit of the Tertiary Aquifer System. The sands of the Black Mingo Formation constitute the major water-bearing strata. Well yields average approximately 230 gpm. Transmissivities in this unit range from 500 to 3,700 ft<sup>2</sup>/day and hydraulic conductivities range between 29 to 170 ft/day (Park, 1985).

Underlying the Black Mingo Formation approximately 700 feet below Mean Sea Level (MSL) are the Peedee, Black Creek, and Middendorf Formations of Late Cretaceous age. These formations consist of interbedded sand, silt, and clay with occasional limestone. Each of these formations is capable of producing groundwater under artesian pressure, however, the major water bearing zones are the Black Creek Aquifer in the Black Creek Formation and the Middendorf Aquifer in the Middendorf Formation.

The lower part of the Black Mingo Formation and the Peedee Formation contains sufficient clays and silts to form an effective vertical hydraulic barrier between the upper Tertiary Aquifer System and the lower Black Creek Aquifer. Another confining unit exists in the lower Black Creek Formation and upper

## DRAFT

Middendorf Formation to separate the Black Creek Aquifer from the Middendorf Aquifer. Hydraulic conductivity in the Black Creek Aquifer has been estimated at 2 to 59 feet/day with a storage coefficient of  $10^{-4}$  (Park, 1985). Groundwater flow direction in the Black Creek Aquifer is to the east. The Middendorf Aquifer is the most productive of the two aquifers with groundwater flow to the east-northeast under a gentle regional hydraulic gradient (Aucott and Speiran, 1985). Both aquifers contain potable water, however, in some areas water quality may have excessive concentrations of dissolved sodium, bicarbonate, and fluoride.

The basement rock in the region is Triassic in age and occurs approximately 3,000 feet below MSL (Park, 1985).

2.3.2 Site Hydrogeology Soil boring and monitoring well data from previous studies indicate that the DFSP site is underlain by 25 to 38 feet of recent fill and fine sands with numerous clay and silt lenses and basal layers of phosphatic gravels of the Ladson Formation. This formation thins towards the north. The surficial aquifer is contained in these materials. Beneath the Ladson Formation and forming the base of the surficial aquifer is the homogeneous, dark green-gray calcareous clay and silt (marl) of the Cooper Formation. This formation is estimated to be 260 feet thick in this area and presents very competent confining layer in the site area (Dames and Moore, 1982). The contact between the Ladson and Cooper Formations is undulatory and varies between 1 and 8 feet above MSL. Depth to the surficial aquifer water table ranged from 5 to 18 feet bls during previous investigations. Some of this variability is based on surface elevations, however, the data suggests that the water table fluctuated by as much as 7 feet at the site.

The general direction of groundwater flow in the surficial aquifer at the site is to the north-northwest. Localized groundwater flow directions at the site may be controlled by topography, with groundwater flow west of the DFSP site toward the west and groundwater flow just north of the DFSP site generally towards the centerline of the north-south valley through which East Lakeside Drive runs.

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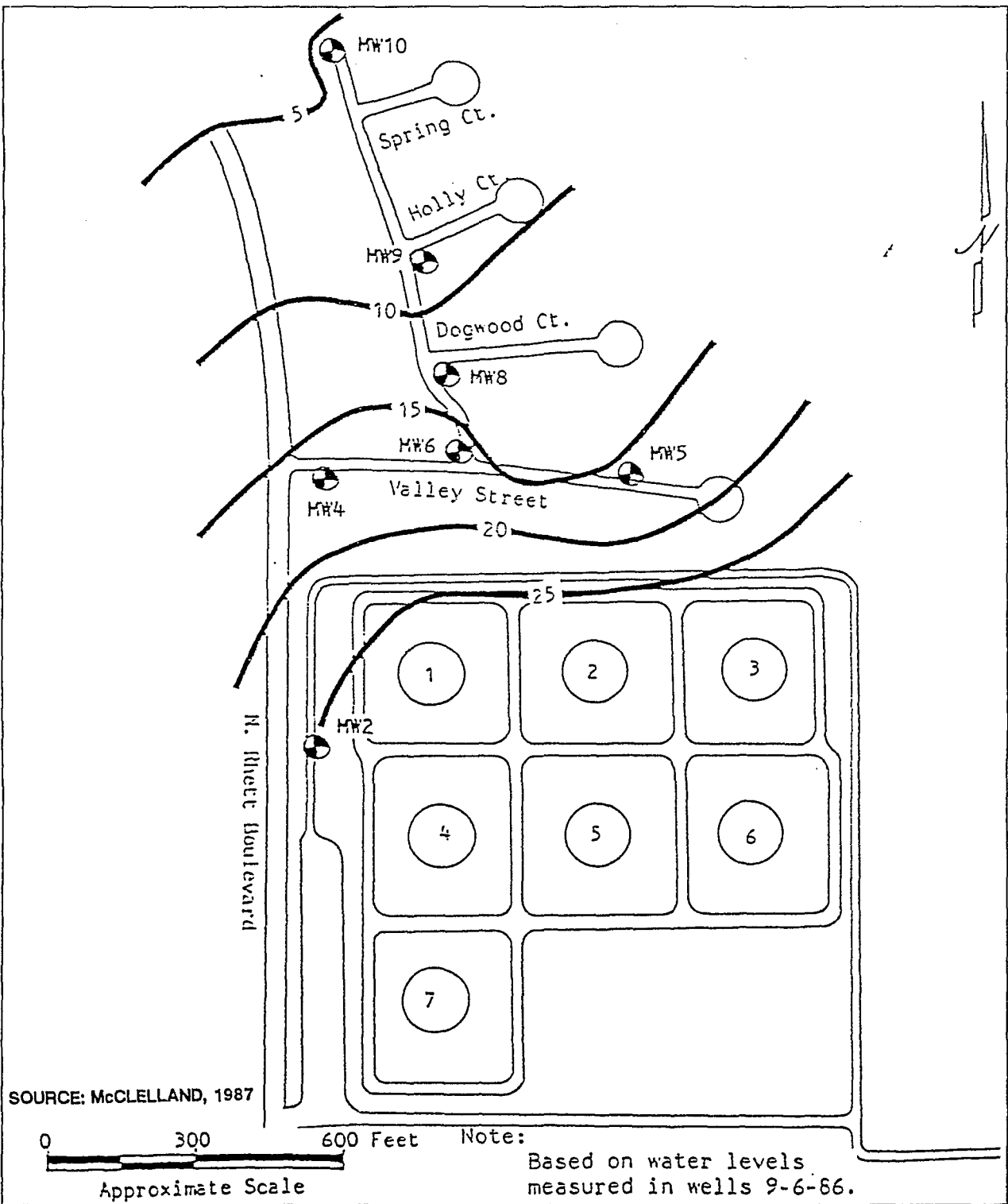
Figure 3 illustrates a water table contour map from data collected on September 6, 1986. Calculations for hydraulic conductivity from monitoring wells at the site using the Hvorslev (1951) method range from  $10^{-4}$  to  $10^{-3}$  cm/sec. An estimated seepage velocity at the DFSP site was calculated as  $8.5 \times 10^{-5}$  cm/sec or 0.24 feet/day using an average hydraulic conductivity of  $8.5 \times 10^{-4}$  cm/sec, an average hydraulic gradient of 0.02, and an effective porosity of 0.20 (McClelland Eng., 1987). It is believed that the discharge of groundwater by the numerous springs in the Gold Cup Springs Lake neighborhood into the ditch on E. Lakeside Drive, along with the routing of groundwater discharges by French drains installed by several residents on Valley Street, may significantly increase the rate of contaminant transport.

### 3.0 PROPOSED ASSESSMENT PLAN

It is proposed that a two phase field investigation be undertaken to assess the suspected contaminant plumes along the eastern and western sides of the DFSP site. The phased approach is discussed in the following two sections. During both the Phase I and Phase II field investigations the ABB-ES field leader will meet on-site or at SDIV with the SDIV Engineer-In-Charge (EIC) on a weekly basis to discuss the field investigation progress and findings.

3.1 PHASE I FIELD INVESTIGATION. The purpose of the Phase I investigations is to assess the approximate horizontal extent of the contaminant plumes at the eastern and western sides of the site by obtaining groundwater samples from temporary wellpoints and soil samples from hand augered soil borings and screening these samples with a field gas chromatograph (groundwater) and Organic Vapor Analyzer (soil). The information obtained during this field screening phase will assess the extent of the contaminant plumes and direct the placement of monitoring wells during the Phase II investigation.

During the Phase I investigation, any necessary permits, off-site utility clearances, and right-of-way easements and private property access approvals will



**FIGURE 3**  
**WATER TABLE CONTOUR MAP**  
**SEPTEMBER 6, 1986**



**CONTAMINATION  
 ASSESSMENT PLAN**

**DEFENSE FUEL SUPPLY POINT  
 HANAHAN, SOUTH CAROLINA**

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be obtained with the help of Navy personnel or their representatives. In addition, information on the location of potable water wells within 1/4 mile radius of the site will be obtained from SDIV, DFSP, SCDHEC, and previous investigation reports.

The Phase I field investigation will consist of installing up to 40 temporary wellpoints along the western side of the DFSP site to assess the western contaminant plume. Up to 16 temporary wellpoints will be installed to assess the eastern contaminant plume. The locations of the proposed temporary wellpoints are shown on Figure 4. The wellpoints will be installed using a KV Macho System or equivalent.

Groundwater samples will be collected at each wellpoint location and screened for the presence of the petroleum contamination constituents benzene, ethylbenzene, toluene, and xylenes (BETX) using a field gas chromatograph (GC). In addition, up to 20 shallow soil borings will be conducted using a hand auger where possible at both the eastern and western contaminated areas to assess soil contamination and local lithology. Soils will be classified in accordance with the Unified Soil Classification System. Soil samples will be collected from each soil boring and placed in 16 ounce glass jars. The soil samples will be screened for petroleum contamination by head space analysis using an Organic Vapor Analyzer (OVA) equipped with a Photoionization Detector (PID).

3.2 PHASE II FIELD INVESTIGATION. The purpose of the Phase II field investigation is to further assess the horizontal extent of the petroleum contamination in the eastern and western areas of the DFSP facility, assess the vertical extent of the petroleum contamination, and characterize the contamination. This will be accomplished through the drilling of soil borings in areas where hand augering could not take place to collect soil samples for OVA screening; the installation of permanent groundwater monitoring wells; the collection of groundwater samples from the monitoring wells for laboratory analysis of jet fuel constituents; surveying of the elevations of the monitoring wells to determine aquifer flow

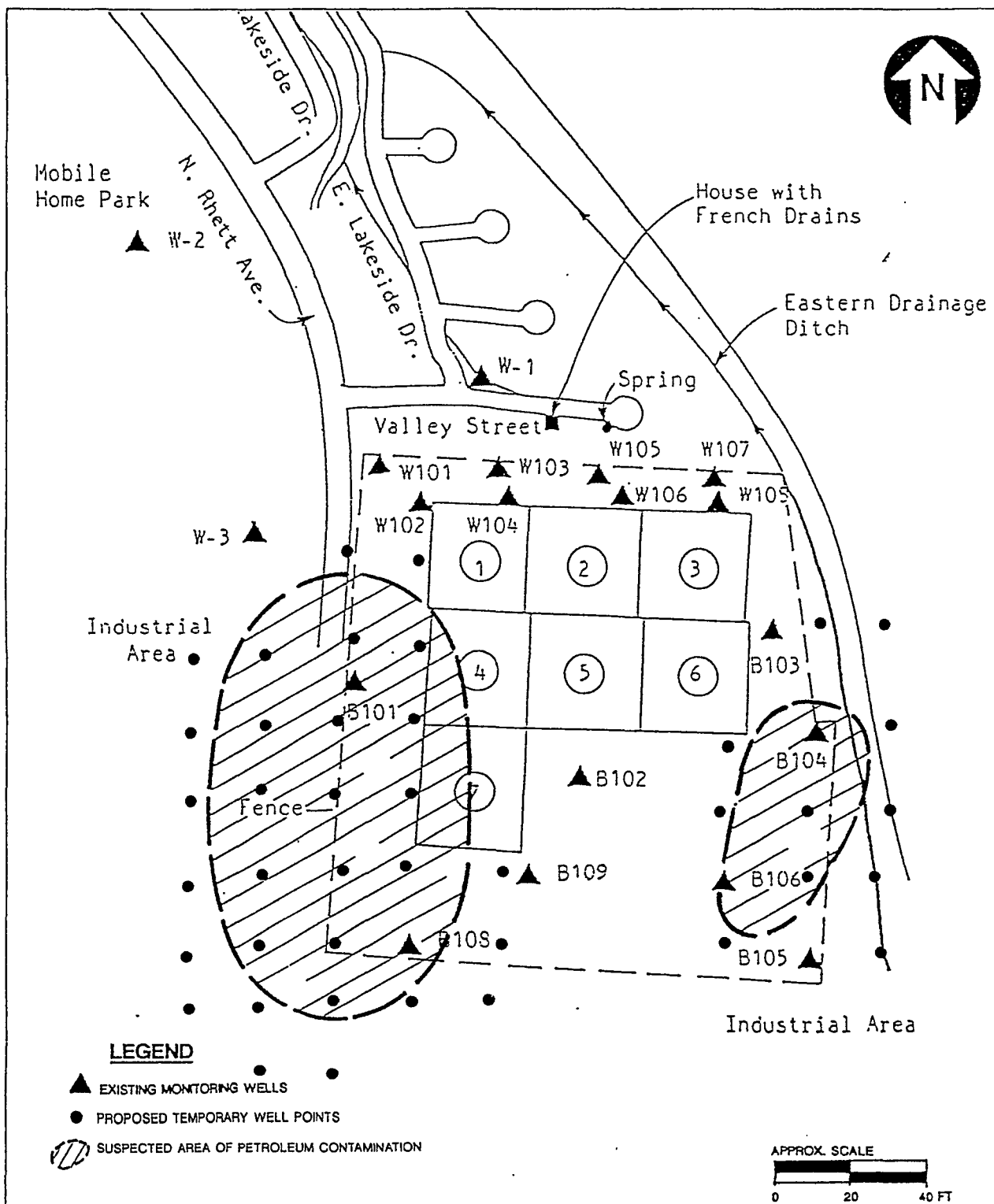


FIGURE 4

PROPOSED WELL POINT LOCATIONS



CONTAMINATION  
ASSESSMENT PLAN

DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA

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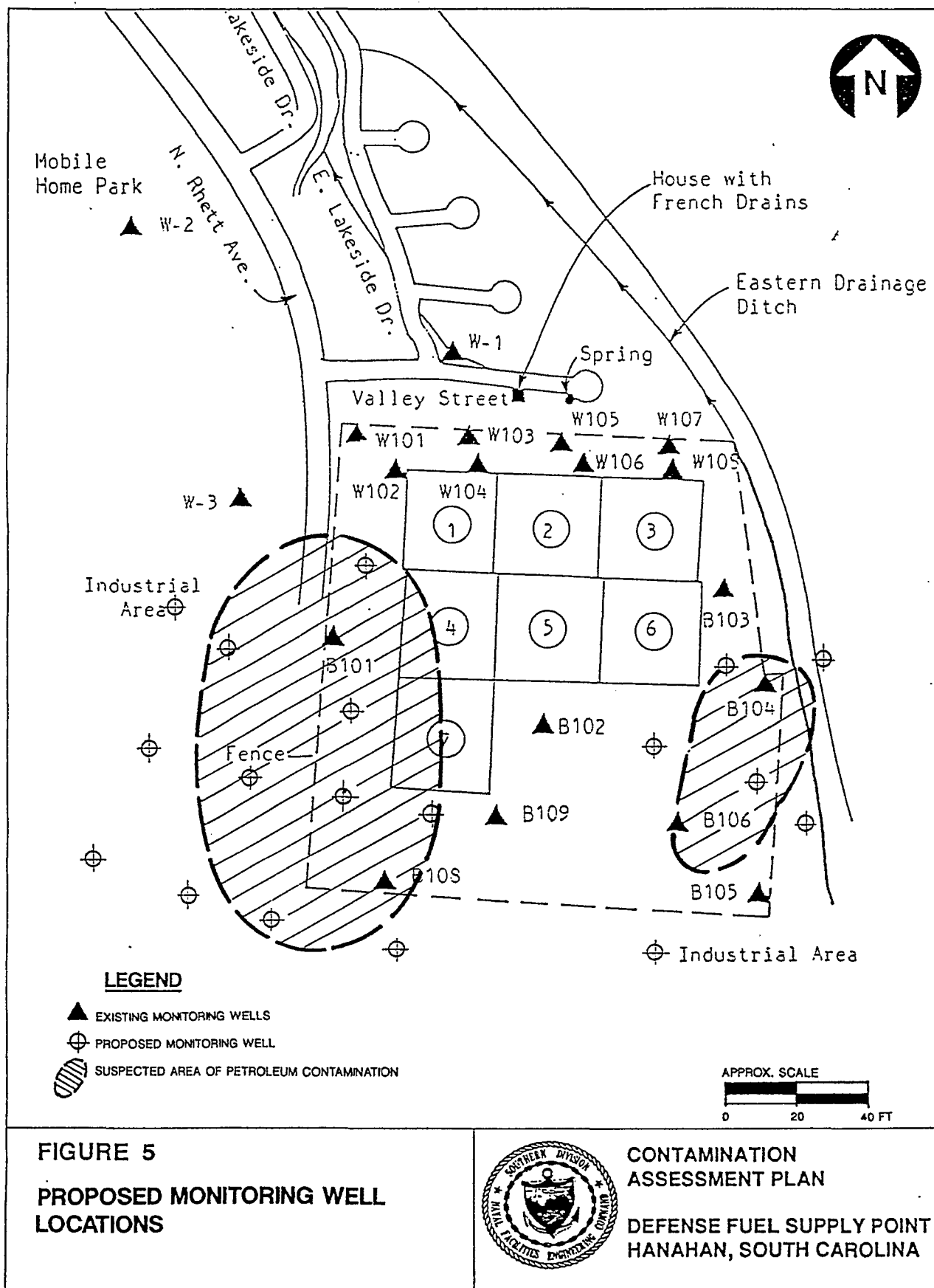
direction and gradient; and aquifer testing on select monitoring wells to estimate aquifer characteristics.

During the Phase II field investigation 18 shallow monitoring wells (up to 15 feet in depth) will be installed at the site to assess the eastern and western contaminant plumes. The location of the proposed monitoring wells is shown on Figure 5; however, exact well placement will depend on the results of the Phase I investigation. All monitoring wells will be constructed of 2-inch inside diameter (ID), flush threaded Schedule 40 polyvinyl chloride (PVC) screen and riser. The well screen will be comprised of a 10 foot section of 0.010 inch slotted screen. Well screens will be set such that a minimum of 2 feet of screen will be above the water table. Depth to the water table in existing wells will be measured to determine the depth interval for the well screen. The remainder of the well casing will consist of solid riser pipe to the ground surface. Total well length and depth for the shallow monitoring wells is not expected to exceed 15 feet bls.

The well annulus will be filter packed with No. 6-20 sand or an acceptable grade of sand to at least 1 foot above the well screen. A 2-foot bentonite seal will be placed above the sand pack with the remaining annular space grouted to the surface. Wells will be flush mounted with the ground surface and will consist of a locking protective cap and a steel subsurface vault set in the pavement around each well riser pipe. Typical construction details for the proposed monitoring wells are provided in Figure 6.

In addition to the monitoring wells, up to 15 shallow soil borings will be advanced with a drill rig in those areas where it was not possible to perform the Phase I manual soil borings.

Upon completion of the monitoring well installation, the wells will be developed using a centrifugal pump until the groundwater is sediment free or as clear as the aquifer will allow in a reasonable amount of time. The measuring point for





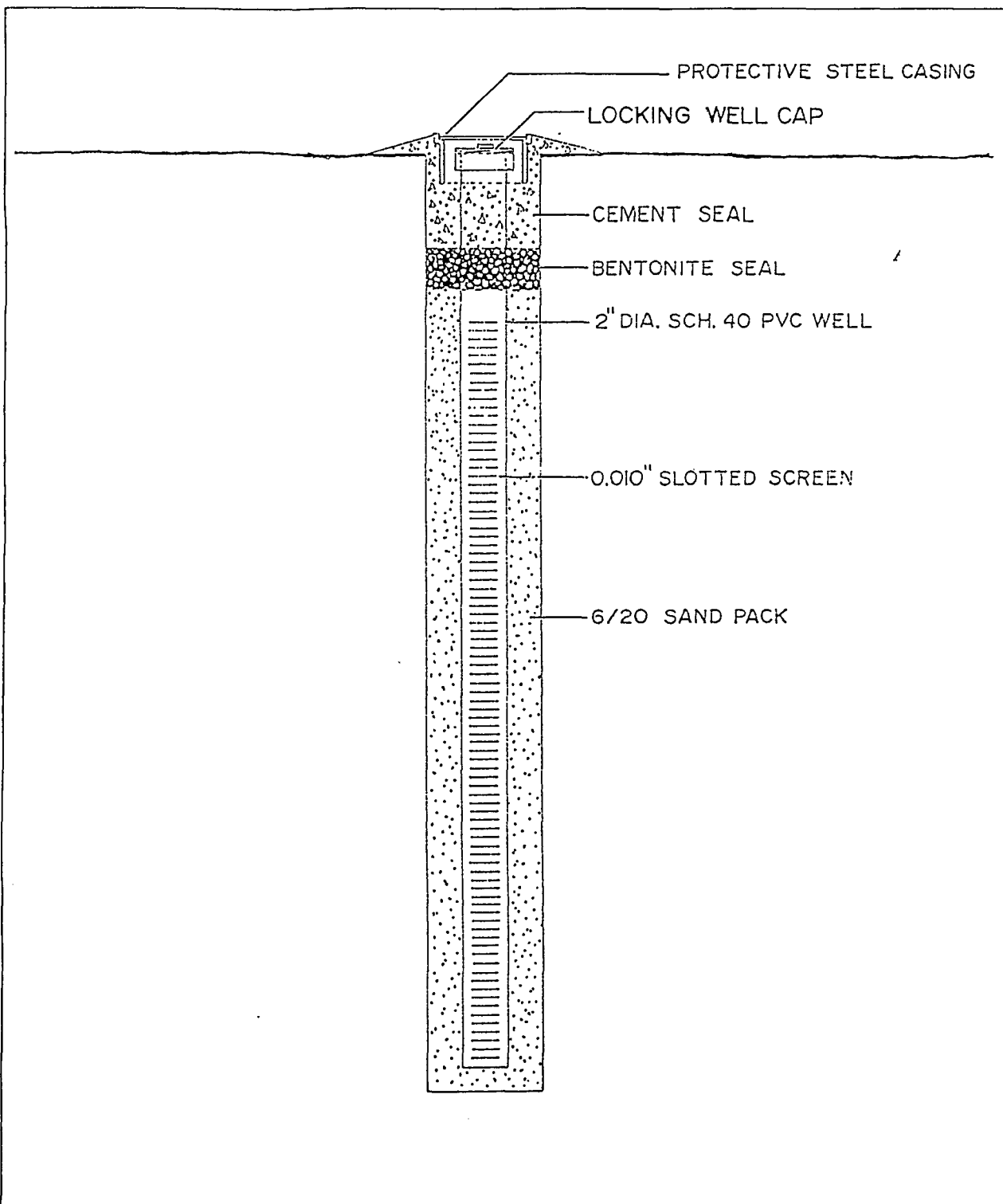


FIGURE 6

TYPICAL MONITORING WELL  
INSTALLATION DETAIL



CONTAMINATION  
ASSESSMENT PLAN

DEFENSE FUEL SUPPLY DEPOT  
HANAHAN, SOUTH CAROLINA

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groundwater elevation on the PVC riser pipe and the land surface adjacent to each monitoring well will be surveyed to within  $\pm 0.01$  feet based on an arbitrary reference elevation of 50 feet.

Groundwater samples will be collected from the newly installed monitoring wells in addition to the eleven existing wells at the site and analyzed for jet fuel constituents (USEPA Methods 602, 610, 239.2, and 418.1). At the western contamination area 16 groundwater samples will be collected and at the eastern area, 13 groundwater samples will be collected. In addition, 3 duplicate samples; 2 equipment blanks; 1 field blank; and 5 trip blanks will be obtained.

Groundwater samples will be shipped via overnight carrier to an approved analytical laboratory. Sampling and the subsequent analytical program will comply with ABB-ES's Comprehensive Quality Assurance Plan (ComQAP).

During the Phase I and II field investigations, ABB-ES personnel and their subcontractors will coordinate efforts with site personnel to dispose of contaminated fluids and soils. ABB-ES and their subcontractors will supply Department of Transportation (DOT) 17-C open top 55-gallon drums and will dispose of contaminated soils, water, and miscellaneous materials (gloves, booties, etc.) into these drums and stage them on site. It will be the Navy's responsibility to dispose of any hazardous waste.

3.3 PREPARATION OF REPORTS. Upon completion of the field investigations and receipt of the analytical laboratory results of the groundwater samples, draft, 100 percent complete, and final Contamination Assessment Reports (CARs) will be prepared and submitted to SDIV for review and approval. The reports will discuss site background information, site conditions, findings, and recommendations for the eastern and western areas of the DFSP site. Recommendations shall be made as to the need for any follow-up reports. Site location maps, locations of soil borings, wellpoints, and monitoring wells, groundwater contour maps, and contamination delineation maps will be included with the reports.

## DRAFT

Based on the findings, conclusions, and recommendations of the final CAR, draft, 90 percent complete, 100 percent complete, and final follow-up reports will be prepared for the two areas of concern. The reports shall be either No Further Action Proposals (NOFAP), Monitoring Only Proposals (MOP), or Preliminary Remedial Action Plans (PRAP).

If a PRAP is developed for the DFSP site it will include the following items:

- summary sheet of the Contamination Assessment Report,
- general discussion of the technical and economic feasibility of the selected remedial system and why it was chosen over other remedial options,
- general discussion of the rationale of the selected system,
- comparison of contaminant levels found with existing state and EPA cleanup criteria in table format,
- disposition and expected contamination concentrations in any effluent from the proposed cleanup method,
- costs estimates and schedules for the design phase, construction/startup phase and the operation phase,
- designation of monitoring wells and proposed methodology for verifying accomplishment of PRAP goals (cleanup levels),
- general discussion of the treatment of contaminated soils, and
- recommendations for conducting pilot studies and obtaining additional information.

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The PRAPs will compare from two to four remedial technologies for cleanup of both groundwater and soil and the selected technology will be justified based on technical and economic feasibility. A conceptual design and rationale for the design will be provided for the selected remedial technology.

It is our understanding that Southern Division will develop performance specifications for construction that are based on the PRAP and the CAR. While these documents will provide some of the information necessary to develop performance specifications, neither document will be biddable. Additional site information that may be needed to develop the performance specifications but not included in this scope is as follows:

- horizontal and vertical survey data,
- locations of existing utilities, and
- location and available amount of electric power.

### 4.0 SCHEDULE

A projected schedule to complete the Contamination Assessment field investigation is approximately 7 weeks. The field investigation is tentatively scheduled to begin the week of August 12, 1991. Upon completion of the field investigation, approximately 3 weeks will be required before receipt of the laboratory analyses of the groundwater samples that were collected during the investigation. A draft Contamination Assessment Report will be prepared and submitted to SDIV by October 29, 1991. If proper time schedules for report review are followed, a draft follow-up report has been scheduled to be delivered to SDIV by December 18, 1991.

## DRAFT

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**SITE-SPECIFIC HEALTH AND SAFETY PLAN  
FOR  
CONTAMINATION ASSESSMENT INVESTIGATION**

**DEFENSE FUEL SUPPLY POINT  
HANAHA, SOUTH CAROLINA**

**CTO NO.: 00010**

**Contract Number N62467-89-D-0317**

**Prepared by:**

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Southern Division  
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**APRIL 1991**



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#### REFERENCES

The following chapters of the Comprehensive Long-term Environmental Action Navy (CLEAN) Program District I Generic HASP are applicable for the work anticipated at the site:

- ☒ 2.0 AUTHORITY AND RESPONSIBILITY OF HEALTH AND SAFETY PERSONNEL
- ☒ 3.0 TRAINING PROGRAM
- ☒ 4.0 MEDICAL SURVEILLANCE PROGRAM
- ☒ 5.0 ENGINEERING CONTROLS
- ☒ 6.0 PERSONAL PROTECTIVE LEVEL DETERMINATION
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  - ☒ ACCIDENT REPORT FORM
  - ☒ HEALTH AND SAFETY OFFICER (HSO) CHECKLIST FOR FIELD OPERATIONS
  - ☒ MATERIAL SAFETY DATA SHEETS
  - ☐ LIQUI-NOX
  - ☐ ETHYL ALCOHOL (denatured)
  - ☐ TRISODIUM PHOSPHATE
  - ☒ OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) POSTER
  - ☒ DAILY HEALTH AND SAFETY AUDIT FORM

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## 1.0 GENERAL

1.1 SCOPE AND PURPOSE. This Health and Safety Plan (HASP) has been prepared in conformance with the Navy CLEAN Program District I (CLEAN) HASP and is intended to meet the requirements of 29 Code of Federal Regulations (CFR) 1910.120. As such, the HASP addresses those activities associated with field operations for this project. Compliance with this HASP is required for all ABB-ES personnel, contractor personnel, or third parties entering the site.

## 1.2 PROJECT PERSONNEL.

1.2.1 Project Manager The project manager (PM) is the individual with overall project management responsibilities. Those responsibilities as they relate to health and safety include provision for the development of this site-specific HASP, the necessary resources to meet requirements of this HASP, the coordination of staff assignments to ensure that personnel assigned to the project meet medical and training requirements, and the means and materials necessary to resolve any health and safety issues that are identified or that develop on the project.

1.2.2 General Site Supervisor The General Site Supervisor is either the PM or the PM's designee who is on-site and vested with the authority by the PM to carry out day-to-day site operations, including interfacing with the site Health and Safety Officer (HSO).

1.2.3 Health and Safety Officer The HSO for this project has been designated by the PM with concurrence of the Health and Safety Supervisor (HSS) or Health and Safety Manager (HSM). The HSO will have at least an indirect line of reporting to the HSM through the HSS for the duration of his/her assignment as project HSO. The HSO is responsible for developing and implementing this site-specific HASP in accordance with the CLEAN HASP. The HSO will investigate all accidents, illnesses, and incidents occurring on-site. The HSO will also conduct safety briefings and site-specific training for on-site personnel. As necessary, the HSO will accompany all U.S. Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), or other governmental agency personnel visiting an ABB-ES site in response to health and safety issues. The HSO, in consultation with the HSS or HSM, is responsible for updating and modifying this HASP as site or environmental conditions change.

1.3 TRAINING. Training is defined under the CLEAN HASP, and all personnel entering potentially contaminated areas of this site must meet the requirements of 29 CFR 1910.120. Personnel without the required training will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 3.0 of the CLEAN HASP for further information.

1.4 MEDICAL SURVEILLANCE. All personnel entering potentially contaminated areas of this site will be medically qualified for site assignment through a medical surveillance program outlined in the CLEAN HASP. Personnel who have not received medical clearance will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 4.0 of the CLEAN HASP for further information.

## 2.0 SITE CHARACTERIZATION AND ANALYSIS

2.1 SITE NAME, LOCATION, AND SIZE. The Defense Fuel Supply Point (DFSP) site is located just east North Rhett Boulevard approximately 3.5 miles east of Charleston Air Force Base within the city limits of Hanahan, South Carolina. The facility occupies approximately 48 acres.

2.2 SITE HISTORY AND LAYOUT. In September 1975, a leak developed in the bottom of one of seven 70,000 barrel capacity aboveground storage tanks. Approximately 83,000 gallons of JP-4 jet fuel was lost. The initial recovery operation recovered approximately 25 percent of the lost fuel. This leak occurred along the northern boundary of the property. Subsequent investigations from 1979 to 1990 indicated that petroleum contaminant plumes may exist along the eastern and western boundaries of the facility as a result of past spills and leaks.

2.3 SCOPE OF WORK (WORK PLAN). ABB-ES will conduct a contamination assessment along the eastern and western boundaries of the facility. The assessment will include shallow soil borings, collection of groundwater samples from temporary wellpoints, and the installation and sampling of permanent monitoring wells. The work will be conducted in Level D protective wear.

### 3.0 TASK ANALYSIS

#### 3.1 TASK ONE.

3.1.1 Hazardous Substances The contaminants of concern known or suspected to be present on-site, along with any established exposure limits for those substances are listed in Table 3-1.

3.1.2 Site Risks The following are the health hazards and safety hazards that are expected to be encountered at the site.

3.1.2.1 Health Hazards Contaminants to which personnel may be exposed are gasoline, diesel fuel, waste oil and their constituents. The primary hazard at the site is from fire/explosion. There should be no smoking allowed in the vicinity of the site. There must be adequate ventilation, especially when sampling in an enclosed or semi-enclosed (i.e., a pit) space. There should always be a fire extinguisher within easy access. The waste oil will contain primarily fuel oil contaminated with water or other substances. The primary component of the waste oil will be polynuclear aromatic hydrocarbons. See Table 1 for a summary of the above contaminants.

Polynuclear aromatic hydrocarbons (PAHs) for the purposes of this plan and study include those listed as parameters for EPA Method 610. Some of the more notable PAHs from this method include acenaphthene, anthracene, chrysene, fluorene, naphthalene, phenanthrene, and pyrene.

All activities at this site are in unconfined areas and will not allow on-site personnel to encounter either high vapor concentrations or strong liquid concentrations of any of the substances described above; therefore, potential health risks are minimal.

3.1.2.2 Safety Hazards Safety hazards include those hazards which personnel may be exposed to that are unrelated to hazardous wastes. These include hazards such as heat stress, operation and presence around heavy equipment, lifting of objects, vehicle traffic, and snake bites. Extreme caution should be exhibited by all personnel while conducting work around drill rigs, backhoes, and other heavy equipment. During hot days, personnel should take time to drink fluids and cool off to avoid overheating and symptoms related to heat stress.

Lifting of heavy objects should be done with caution. Personnel should assist one another with moving heavy objects or use the appropriate equipment to accomplish these tasks. During all site activities, personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes.

Power substations, powerlines, underground utilities, and underground pipelines are to be avoided during drilling operations. Necessary work permits for activities at the Naval activities will be obtained from the Public Works Department or the appropriate department (e.g., fire department, etc.).



**Table 3-1  
Contaminants of Concern**

Health and Safety Plan  
Defense Fuel Supply Point  
Hanahan, South Carolina

Chemical	Approximate odor Thresh- old (ppm)	Permissible Exposure Limits (ppm)	Threshold Limit Value (ppm)	Physical Characteristics	Dermal Toxicity	Remarks
Benzene	4.68	1	10	Colorless liquid, pleasant aromatic odor.	Moderate skin irritant.	Inhalation of large amounts attacks central nervous sys- tem (CNS); chronic poisoning causes leukemia.
Ethyl benzene	140	100	10	Colorless liquid, aro- matic odor.	Moderate skin irri- tant.	Liquid blisters skin, inhalation results in dizziness, depres- sion.
Toluene	0.17	100	100	Colorless liquid, pleas- ant aromatic odor.	Mild skin irritant.	Ingestion or aspiration can cause pulmonary edema, de- pressed respiration.
Xylene	0.05	100	200	Colorless liquid, aro- matic odor.	Moderate skin irri- tant.	Inhalation causes headache and dizziness; vapors irritate eyes; can be fatal if ingested.
Naphthalene	--	10	10	Colorless to brown solid with an odor of mothballs	Moderate skin irritant	Inhalation causes headache and confusion; vapors irritate eyes.
Lead	--	--	--	Soft, ductile, gray, metal, soluble in water containing a weak acid.	--	Lead poisoning may cause fatigue, anemia, abdominal pains, and neurological dam- age.

Notes: ppm = parts per million.

**3.1.2.3 Conclusions and Risk Assessment** Based on all of the available information (nature of the work, potential onsite chemicals and their properties, exposure limits, etc.), hazards associated with conducting the described field work are considered to be low, assuming appropriate health and safety practices are maintained.

**3.1.3 Protective Measures** The following are the protective measures that will be used at the site.

**3.1.3.1 Engineering Controls** Whenever needed, engineering controls (i.e., fans to blow volatilized chemicals away from the work area) will be used.

**3.1.3.2 Levels of Protection** A level D work uniform will be used at the site. Level D Protection should only be used when the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.

3.1.4 Monitoring It is intended that real time monitoring instrumentation will be used to monitor the work environment in order to ensure the appropriate level of protection for the site team.

3.1.4.1 Air Sampling To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the site, and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site. Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

1. Photovac Organic Vapor Analyzer 10S50 (OVA)

If the OVA detects a steady measurable quantity of organic vapors greater than 5 ppm (above background conditions) in the breathing zone, the field team will withdraw from the site until health and safety conditions at the site are reevaluated.

3.1.4.2 Personal Monitoring Personal monitoring will be undertaken to characterize the personal exposure of high risk employees to the hazardous substances they may encounter on-site. Personal monitoring will be conducted on a representative basis. Personnel who are represented by the sampling will be noted in field logs.

The following personal monitoring equipment will be used at the site. Refer to Chapter 7.0 of the CLEAN HASP for information on the maintenance and calibration of the equipment.

1. Thermoluminescent Dosimetry Body Badge

#### 4.0 DATA SHEETS

Hanahan.HSP  
FGB.04.91 (CLEAN.01)

# BENZENE

BNZ

<b>Common Synonyms</b> Benzol Benzole	<b>Watery liquid</b>  <b>Colorless</b>  <b>Gasoline-like odor</b>  Floats on water. Flammable, irritating vapor is produced. Freezing point is 42°F.
Avoid contact with liquid and vapor. Keep people away. Wear goggles and self-contained breathing apparatus. Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.	
<b>Fire</b>	<b>FLAMMABLE.</b> Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
<b>Exposure</b>	<b>CALL FOR MEDICAL AID</b>  <b>VAPOR</b> Irritating to eyes, nose and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  <b>LIQUID</b> Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
<b>Water Pollution</b>	<b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.</b> May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Restrict access	<b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C <sub>6</sub> H <sub>6</sub> 3.3 IMO/UN Designation: 3.2/1114 3.4 DOT ID No.: 1114 3.5 CAS Registry No.: 71-43-2	<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic, rather pleasant aromatic odor; characteristic odor
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a hose mask; hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield; hydrocarbon-insoluble apron such as neoprene. 5.2 Symptoms Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death. 5.3 Treatment of Exposure: SKIN: flush with water followed by soap and water; remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician. IF breathing is irregular or stopped, start resuscitation, administer oxygen. 5.4 Threshold Limit Value: 10 ppm 5.5 Short Term Inhalation Limit: 75 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; LD <sub>50</sub> = 50 to 500 mg/kg 5.7 Late Toxicity: Leukemia 5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smearing and reddening of the skin. 5.10 Odor Threshold: 4.68 ppm 5.11 IDLH Value: 2,000 ppm	

<b>6. FIRE HAZARDS</b> 6.1 Flash Point: 12°F C.C. 6.2 Flammable Limits in Air: 1.3%-7.9% 6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back 6.7 Ignition Temperature: 1087°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 6.0 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available	<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-U-V-W																																				
<b>7. CHEMICAL REACTIVITY</b> 7.1 Reactivity With Water: No reaction 7.2 Reactivity With Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 32	<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation: <table> <thead> <tr> <th>Category</th><th>Rating</th></tr> </thead> <tbody> <tr> <td>Fire</td><td>3</td></tr> <tr> <td>Health</td><td></td></tr> <tr> <td>Vapor Irritant</td><td>1</td></tr> <tr> <td>Liquid or Solid Irritant</td><td>1</td></tr> <tr> <td>Poisons</td><td>3</td></tr> <tr> <td>Water Pollution</td><td></td></tr> <tr> <td>Human Toxicity</td><td>3</td></tr> <tr> <td>Aquatic Toxicity</td><td>1</td></tr> <tr> <td>Aesthetic Effect</td><td>3</td></tr> <tr> <td>Reactivity</td><td></td></tr> <tr> <td>Other Chemicals</td><td>2</td></tr> <tr> <td>Water</td><td>1</td></tr> <tr> <td>Sell Reaction</td><td>0</td></tr> </tbody> </table> 11.3 NFPA Hazard Classification: <table> <thead> <tr> <th>Category</th><th>Classification</th></tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td><td>2</td></tr> <tr> <td>Flammability (Red)</td><td>3</td></tr> <tr> <td>Reactivity (Yellow)</td><td>0</td></tr> </tbody> </table>	Category	Rating	Fire	3	Health		Vapor Irritant	1	Liquid or Solid Irritant	1	Poisons	3	Water Pollution		Human Toxicity	3	Aquatic Toxicity	1	Aesthetic Effect	3	Reactivity		Other Chemicals	2	Water	1	Sell Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
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Flammability (Red)	3																																				
Reactivity (Yellow)	0																																				
<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 5 ppm/6 hr/minnow/lethal/distilled water 20 ppm/24 hr/sunfish/TL <sub>50</sub> /tap water 8.2 Waterflow Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 1.2 lb/lb, 10 days 8.4 Food Chain Concentration Potential: None	<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 78.11 12.3 Boiling Point at 1 atm: 176°F = 80.1°C = 353.3°K 12.4 Freezing Point: 42.0°F = 5.5°C = 278.7°K 12.5 Critical Temperature: 552.0°F = 288.9°C = 562.1°K 12.6 Critical Pressure: 710 psia = 48.3 atm = 4.85 MN/m <sup>2</sup> 12.7 Specific Gravity: 0.879 at 20°C (liquid) 12.8 Liquid Surface Tension: 26.8 dynes/cm = 0.0268 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 35.0 dynes/cm = 0.035 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: 2.7 12.11 Ratio of Specific Heats of Vapor (Gas): 1.061 12.12 Latent Heat of Vaporization: 169 Btu/lb = 84.1 cal/g = 3.54 X 10 <sup>3</sup> J/kg 12.13 Heat of Combustion: -17,460 Btu/lb = -9696 cal/g = -406.0 X 10 <sup>3</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 30.45 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 3.22 psia																																				
<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Industrial pure ..... 99+ % Thiophene-free ..... 99+ % Nimston ..... 99+ % Industrial 90% ..... 85+ % Reagent ..... 99+ % 9.2 Storage Temperature: Open 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum																																					
<b>NOTES</b>																																					

# ETHYLBENZENE

ETB

Common Synonyms Phenylethane EB		Liquid	Colorless	Sweet, gasoline-like odor
		Floats on water. Flammable, irritating vapor is produced.		
Avoid contact with liquid and vapor; keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.				
Fire		FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective or fire. Cool exposed containers with water.		
Exposure		VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness or difficult breathing. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  LIQUID Will burn skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. If in EYES, hold eyes open and flush with plenty of water. If SWALLOWED and victim is CONSCIOUS, have victim drink water. DO NOT INDUCE VOMITING.		
Water Pollution		HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and waste officials. Notify operators of nearby water intakes.		
1. RESPONSE TO DISCHARGE (See Response Methods Handbook)		2. LABEL		
Mechanical containment Should be removed Chemical and physical treatment		2.1 Category: Flammable liquid 2.2 Class: 3		
3. CHEMICAL DESIGNATIONS		4. OBSERVABLE CHARACTERISTICS		
3.1 CG Compatibility Class: Aromatic hydrocarbon 3.2 Formula: C <sub>8</sub> H <sub>10</sub> 3.3 IMO/UN Designation: 2.3/1175 3.4 DOT ID No.: 1175 3.5 CAS Registry No.: 100-41-4		4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic		
5. HEALTH HAZARDS				
5.1 Personal Protective Equipment: Self-contained breathing apparatus; safety goggles.				
5.2 Symptoms Following Exposure: Inhalation may cause irritation of nose, dizziness, depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters.				
5.3 Treatment of Exposure: INHALATION: If ill effects occur, remove victim to fresh air, keep him warm and quiet, and get medical help promptly; if breathing stops, give artificial respiration. INGESTION: induce vomiting only upon physician's approval; material in lung may cause chemical pneumonitis. SKIN AND EYES: promptly flush with plenty of water (15 min. for eyes) and get medical attention; remove and wash contaminated clothing before reuse.				
5.4 Threshold Limit Value: 100 ppm				
5.5 Short Term Inhalation Limit: 200 ppm for 30 min.				
5.6 Toxicity by Ingestion: Grade 2; LD <sub>50</sub> = 0.5 to 5 g/kg (rat)				
5.7 Late Toxicity: Data not available				
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.				
5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.				
5.10 Odor Threshold: 140 ppm				
5.11 IDLH Value: 2,000 ppm				

6. FIRE HAZARDS		10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U	
6.1 Flash Point: 80°F O.C.; 59°F C.C.		11. HAZARD CLASSIFICATIONS	
6.2 Flammable Limits in Air: 1.0%-6.7%		11.1 Code of Federal Regulations: Flammable liquid	
6.3 Fire Extinguishing Agents: Foam (most effective), water fog, carbon dioxide or dry chemical.		11.2 HAS Hazard Rating for Bulk Water Transportation:	
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent		Category Rating	
6.5 Special Hazards of Combustion: Products: Irritating vapors are generated when heated.		Fire..... 3	
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to the source of ignition and flash back.		Health	
6.7 Ignition Temperature: 860°F		Vapor Irritant..... 2	
6.8 Electrical Hazard: Not pertinent		Liquid or Solid Irritant..... 2	
6.9 Burning Rate: 5.6 mm/min.		Poisons..... 2	
6.10 Adiabatic Flame Temperature: Data Not Available		Water Pollution	
(Continued)		Human Toxicity..... 1	
7. CHEMICAL REACTIVITY		Aquatic Toxicity..... 3	
7.1 Reactivity With Water: No reaction		Aesthetic Effect..... 2	
7.2 Reactivity with Common Materials: No reaction		Reactivity	
7.3 Stability During Transport: Stable		Other Chemicals..... 1	
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent		Water..... 0	
7.5 Polymerization: Not pertinent		Self Reaction..... 0	
7.6 Inhibitor of Polymerization: Not pertinent		11.3 NFPA Hazard Classification:	
7.7 Molar Ratio (Reactant to Product): Data Not Available		Category Classification	
7.8 Reactivity Group: 32		Health Hazard (Blue)..... 2	
8. WATER POLLUTION		Flammability (Red)..... 3	
8.1 Aquatic Toxicity: 28 ppm/96 hr/bluegill/TL <sub>50</sub> /fresh water		Reactivity (Yellow)..... 0	
8.2 Waterfowl Toxicity: Data not available		12. PHYSICAL AND CHEMICAL PROPERTIES	
8.3 Biological Oxygen Demand (BOD): 2.8% (theor.), 5 days		12.1 Physical State at 15°C and 1 atm: Liquid	
8.4 Food Chain Concentration Potential: None		12.2 Molecular Weight: 106.17	
9. SHIPPING INFORMATION		12.3 Boiling Point at 1 atm: 277.2°F = 136.2°C = 408.4°K	
9.1 Grades of Purity: Research grade: 99.98%; pure grade: 99.5%; technical grade: 99.0%		12.4 Freezing Point: -138°F = -95°C = 178°K	
9.2 Storage Temperature: Ambient		12.5 Critical Temperature: 651.0°F = 343.9°C = 617.1°K	
9.3 Inert Atmosphere: No requirement		12.6 Critical Pressure: 523 psia = 35.6 atm = 3.61 MN/m <sup>2</sup>	
9.4 Venting: Open (flame arrester) or pressure-vacuum		12.7 Specific Gravity: 0.867 at 20°C (liquid)	
6. FIRE HAZARDS (Continued)		12.8 Liquid Surface Tension: 29.2 dynes/cm = 0.0292 N/m at 20°C	
6.11 Stoichiometric Air to Fuel Ratio: Data Not Available		12.9 Liquid Water Interfacial Tension: 35.46 dynes/cm = 0.03546 N/m at 20°C	
6.12 Flame Temperature: Data Not Available		12.10 Vapor (Gas) Specific Gravity: Not pertinent	
		12.11 Ratio of Specific Heats of Vapor (Gas): 1.071	
		12.12 Latent Heat of Vaporization: 144 Btu/lb = 80.1 cal/g = 3.35 X 10 <sup>5</sup> J/kg	
		12.13 Heat of Combustion: -17,780 Btu/lb = -9677 cal/g = -413.5 X 10 <sup>3</sup> J/kg	
		12.14 Heat of Decomposition: Not pertinent	
		12.15 Heat of Solution: Not pertinent	
		12.16 Heat of Polymerization: Not pertinent	
		12.25 Heat of Fusion: Data Not Available	
		12.26 Limiting Value: Data Not Available	
		12.27 Reid Vapor Pressure: 0.4 psia	

# ETHYLENE DIBROMIDE

EDB

<b>Common Synonyms</b> 1, 2-Dibromoethane Ethylene bromide Bromofume sym-Dibromoethane Dow-fume 40, W-10, W-15, W-40 Glycol dibromide		<b>Liquid</b>  <b>Colorless</b>  <b>Sweet odor</b>	<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) <b>A-X</b>																																				
<b>Sinks in water. Poisonous vapor is produced.</b> <b>Freezing point is 50°F.</b>																																							
Stop discharge if possible. Keep people away. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.																																							
<b>Fire</b>	Not flammable. <b>POISONOUS GASES ARE PRODUCED WHEN HEATED.</b> Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Cool exposed containers with water.																																						
<b>Exposure</b>	<b>CALL FOR MEDICAL AID.</b>  <b>VAPOR</b> <b>POISONOUS IF INHALED.</b> Irritating to eyes, nose and throat. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  <b>LIQUID</b> <b>POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.</b> Irritating to skin and eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.																																						
<b>Water Pollution</b>	<b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.</b> May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.																																						
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Should be removed Chemical and physical treatment		<b>2. LABEL</b> 2.1 Category: None 2.2 Class: Not pertinent																																					
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: BrCH <sub>2</sub> CH <sub>2</sub> Br 3.3 IMO/UN Designation: 6.1/1605 3.4 DOT ID No.: 1605 3.5 CAS Registry No.: 106-93-4		<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Mildly sweet; like chloroform																																					
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Canister type mask or self-contained air mask; neoprene gloves; chemical safety goggles. 5.2 Symptoms Following Exposure: Local inflammation, blisters and ulcers on skin; irritation in lungs and organic injury to liver and kidneys; may be absorbed through skin. 5.3 Treatment of Exposure: Remove from exposure. Remove contaminated clothing. Wash skin with soap and water. Flush eyes with plenty of water. Consult physician. 5.4 Threshold Limit Value: 2 ppm 5.5 Short Term Inhalation Limits: 50 ppm for 5 min. 5.6 Toxicity by Ingestion: Grade 3; LD <sub>50</sub> = 50 to 500 mg/kg 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: Data not available 5.11 IDLH Value: 400 ppm																																							
<b>6. FIRE HAZARDS</b> 6.1 Flash Point: Not flammable 6.2 Flammable Limits in Air: Not flammable 6.3 Fire Extinguishing Agents: Not pertinent 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion: Products: Decomposition gases are toxic and irritating. 6.6 Behavior in Fire: Decomposes into toxic irritating gases. Reacts with hot metals such as aluminum and magnesium. 6.7 Ignition Temperature: Not flammable 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Not flammable 6.10 Adiabatic Flame Temperature: Data Not Available 6.11 Stoichiometric Air to Fuel Ratio: Data Not Available 6.12 Flame Temperature: Data Not Available																																							
<b>7. CHEMICAL REACTIVITY</b> 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data Not Available 7.8 Reactivity Group: S6																																							
<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 16 mg/l/48 hr/bluegill/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: None																																							
<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Commercial 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum																																							
<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: ORM-A 11.2 NAS Hazard Rating for Bulk Water Transportation: <table><thead><tr><th>Category</th><th>Rating</th></tr></thead><tbody><tr><td>Fire.....</td><td>0</td></tr><tr><td>Health.....</td><td></td></tr><tr><td>Vapor Irritant.....</td><td>1</td></tr><tr><td>Liquid or Solid Irritant.....</td><td>1</td></tr><tr><td>Poisons.....</td><td>3</td></tr><tr><td>Water Pollution.....</td><td></td></tr><tr><td>Human Toxicity.....</td><td>3</td></tr><tr><td>Aquatic Toxicity.....</td><td>3</td></tr><tr><td>Aesthetic Effect.....</td><td>2</td></tr><tr><td>Reactivity.....</td><td></td></tr><tr><td>Other Chemicals.....</td><td>1</td></tr><tr><td>Water.....</td><td>0</td></tr><tr><td>Self Reaction.....</td><td>0</td></tr></tbody></table> 11.3 NFPA Hazard Classification: <table><thead><tr><th>Category</th><th>Classification</th></tr></thead><tbody><tr><td>Health Hazard (Blue).....</td><td>3</td></tr><tr><td>Flammability (Red).....</td><td>0</td></tr><tr><td>Reactivity (Yellow).....</td><td>0</td></tr></tbody></table>				Category	Rating	Fire.....	0	Health.....		Vapor Irritant.....	1	Liquid or Solid Irritant.....	1	Poisons.....	3	Water Pollution.....		Human Toxicity.....	3	Aquatic Toxicity.....	3	Aesthetic Effect.....	2	Reactivity.....		Other Chemicals.....	1	Water.....	0	Self Reaction.....	0	Category	Classification	Health Hazard (Blue).....	3	Flammability (Red).....	0	Reactivity (Yellow).....	0
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<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 187.86 12.3 Boiling Point at 1 atm: 266°F = 131°C = 404°K 12.4 Freezing Point: 48.6°F = 8.8°C = 282.0°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 2.160 at 20°C (liquid) 12.8 Liquid Surface Tension: 36.75 dynes/cm = 0.03675 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 36.54 dynes/cm = 0.03654 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.109 12.12 Latent Heat of Vaporization: 82.1 Btu/lb = 45.6 cal/g = 1.91 X 10 <sup>4</sup> J/kg 12.13 Heat of Combustion: Not pertinent 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 13.79 cal/g 12.26 Limiting Value: Data Not Available 12.27 Reid Vapor Pressure: 0.4 psia																																							
<b>NOTES</b>																																							

# TETRAETHYL LEAD

TEL

<b>Common Synonyms</b> TEL Lead tetraethyl		Oily liquid Colorless, but generally dyed red Fruity odor Sinks in water. Poisonous, flammable vapor is produced.
AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Stop discharge if possible. Call fire department. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.		
<b>Fire</b>	Combustible. <b>POISONOUS GASES ARE PRODUCED IN FIRE.</b> Containers may explode in fire. Vapor may explode if ignited in an enclosed area. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Combat fires from behind barrier or protected location. Flood discharge area with water. Extinguish with water, dry chemical, foam, or carbon dioxide. Cool exposed containers with water.	
<b>Exposure</b>	CALL FOR MEDICAL AID. <b>VAPOR</b> <b>POISONOUS IF INHALED OR IF SKIN IS EXPOSED.</b> Irritating to eyes. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. <b>LIQUID</b> <b>POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.</b> Will burn eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.	
<b>Water Pollution</b>	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-poison, water contaminant Restrict access Should be removed Chemical and physical treatment		<b>2. LABEL</b> 2.1 Category: Poison 2.2 Class: 6
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Not listed 3.2 Formula: $Pb(C_2H_5)_4$ 3.3 IMO/UN Designation: 6.1/1649 3.4 DOT ID No.: 1649 3.5 CAS Registry No.: 78-00-2		<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Dyed red or other distinctive color. 4.3 Odor: Sweet
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Organic vapor type canister face mask for short periods; air line type for longer periods; neoprene-coated, liquid-proof gloves; protective goggles or face shield; white or light-colored clothing; rubber shoes or boots. 5.2 Symptoms Following Exposure: Increased urinary output of lead. If a large degree of absorption from inhalation or skin contact, may cause insomnia, excitability, delirium, coma and death. Do not confuse with inorganic lead. 5.3 Treatment of Exposure: Remove victim from contaminated area and consult physician immediately. INGESTION: induce vomiting. SKIN: wash immediately with kerosene or similar petroleum distillate followed by soap and water. 5.4 Threshold Limit Value: 0.1 mg/m <sup>3</sup> 5.5 Short Term Inhalation Limits: 0.15 mg Pb/m <sup>3</sup> for 30 min. 5.6 Toxicity by Ingestion: Oral rat LD <sub>50</sub> = 17 mg/kg 5.7 Late Toxicity: Lead poisoning 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure. 5.10 Odor Threshold: Data not available 5.11 IDLH Value: 40 mg/m <sup>3</sup>		

<b>6. FIRE HAZARDS</b> 6.1 Flash Point: 200°F C.C.; 185°F O.C. 6.2 Flammable Limits in Air: Data not available 6.3 Fire Extinguishing Agents: Water, foam, dry chemical, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion: Products: Toxic gases are generated in fires. 6.6 Behavior in Fire: May explode in fires. 6.7 Ignition Temperature: Decomposes above 230°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: Data not available 6.10 Adiabatic Flame Temperature: Data not available	<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-X-Y								
(Continued)	<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Poison, B 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: <table> <tr> <td>Category</td><td>Classification</td></tr> <tr> <td>Health Hazard (Blue).....</td><td>3</td></tr> <tr> <td>Flammability (Red).....</td><td>2</td></tr> <tr> <td>Reactivity (Yellow).....</td><td>3</td></tr> </table>	Category	Classification	Health Hazard (Blue).....	3	Flammability (Red).....	2	Reactivity (Yellow).....	3
Category	Classification								
Health Hazard (Blue).....	3								
Flammability (Red).....	2								
Reactivity (Yellow).....	3								
<b>7. CHEMICAL REACTIVITY</b> 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: Rust and some metals cause decomposition. 7.3 Stability During Transport: Stable below 230°F. At higher temperatures, may detonate or explode when confined. 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: Data not available	<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 325.44 12.3 Boiling Point at 1 atm: Decomposes 12.4 Freezing Point: -215°F = -157°C = 136°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.633 at 20°C (liquid) 12.8 Liquid Surface Tension: 26.5 dynes/cm = 0.0265 N/m at (est.) 25°C 12.9 Liquid Water Interfacial Tension: (est.) 40 dynes/cm = 0.04 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: Not pertinent 12.13 Heat of Combustion: (est.) -7,670 Btu/lb = -4,380 cal/g = -183 X 10 <sup>3</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.17 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available								
<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 0.20 mg/l/96 hr/bluegill/TL <sub>50</sub> /fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: Data not available	<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Technical 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum								
<b>6. FIRE HAZARDS (Continued)</b> 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available									

# TOLUENE

TOL

Common Synonyms	Watery liquid	Colorless	Pleasant odor
Toluol Methylbenzene Methylbenzol	Floats on water. Flammable, irritating vapor is produced.		
Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to "knock down" vapor. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.			
Fire	FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.		
Exposure	CALL FOR MEDICAL AID.  VAPOR Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness.  Move to fresh air. If breathing has stopped, give artificial respiration. If breathing difficult, give oxygen.  LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.		
Water Pollution	Dangerous to aquatic life in high concentrations. Fouling to shoreline. May be dangerous if it enters water intakes.  Notify local health and wildlife officials. Notify operators of nearby water intakes.		
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Issue warning-high flammability Evacuate area		2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3	
3. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C <sub>7</sub> H <sub>8</sub> 3.3 IMO/UN Designation: 3.2/1294 3.4 DOT ID No.: 1294 3.5 CAS Registry No.: 106-88-3		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant	
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves. 5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration. 5.3 Treatment of Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limits: 600 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 2; LD <sub>50</sub> = 0.5 to 5 g/kg 5.7 Late Toxicity: Kidney and liver damage may follow ingestion. 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.17 ppm 5.11 IDLH Value: 2,000 ppm			

<p><b>6. FIRE HAZARDS</b> 6.1 Flash Point: 40°F C.C.; 55°F O.C. 6.2 Flammable Limits in Air: 1.27%-7% 6.3 Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires. 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 957°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 5.7 mm/min. 6.10 Adiabatic Flame Temperature: Data not available</p>	<p><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-U</p>
<p>(Continued)</p>	<p><b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire..... 3 Health Vapor Irritant..... 1 Liquid or Solid Irritant..... 1 Poisons..... 2 Water Pollution Human Toxicity..... 1 Aquatic Toxicity..... 3 Aesthetic Effect..... 2 Reactivity Other Chemicals..... 1 Water..... 0 Self Reaction..... 0 11.3 NFPA Hazard Classification: Category Classification Health Hazard (Blue)..... 2 Flammability (Red)..... 3 Reactivity (Yellow)..... 0</p>
<p><b>7. CHEMICAL REACTIVITY</b> 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 32</p>	<p><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 92.14 12.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K 12.4 Freezing Point: -129°F = -95.0°C = 175.2°K 12.5 Critical Temperature: 605.4°F = 318.6°C = 591.8°K 12.6 Critical Pressure: 596.1 psia = 40.55 atm = 4.108 MN/m<sup>2</sup> 12.7 Specific Gravity: 0.867 at 20°C (liquid) 12.8 Liquid Surface Tension: 29.0 dynes/cm = 0.0290 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.089 12.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61 X 10<sup>3</sup> J/kg 12.13 Heat of Combustion: -17,430 Btu/lb = -9566 cal/g = -405.5 X 10<sup>3</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: 17.17 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 1.1 psia</p>
<p><b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 1180 mg/L/96 hr/sunfish/TL<sub>50</sub>/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0%, 5 days; 36% (theor), 6 days 8.4 Food Chain Concentration Potential: None</p>	<p><b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Research, reagent, nitration-all 99.6 + %; industrial: contains 54 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 80/120: less pure than industrial. 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or pressure-vacuum</p>
<p><b>6. FIRE HAZARDS (Continued)</b> 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>	



# m-XYLENE

XLM

Common Synonyms 3-Dimethylbenzene xylol		Watery liquid	Colorless	Sweet odor
Floats on water. Flammable, irritating vapor is produced.				
Stop discharge if possible. Keep people away. Call fire department. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.				
Fire	<b>FLAMMABLE</b> Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear self-contained breathing apparatus. Extinguish with foam, dry chemical, or carbon dioxide. Water may be ineffective or fire. Cool exposed containers with water.			
Exposure	<b>CALL FOR MEDICAL AID.</b>  <b>VAPOR</b> Irritating to eyes, nose, and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  <b>LIQUID</b> Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.			
Water Pollution	<b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.</b> Fouling to shoreline. May be dangerous if it enters water intakes.  Notify local health and wildlife officials. Notify operators of nearby water intakes.			
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Evacuate area Should be removed Chemical and physical treatment		<b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3		
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: m-C <sub>6</sub> H <sub>4</sub> (CH <sub>3</sub> ) <sub>2</sub> 3.3 IMO/IUN Designation: 5.2/1307 3.4 DOT ID No.: 1307 3.5 CAS Registry No.: 108-38-3		<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Like benzene; characteristic aromatic		
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots. 5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma; can be fatal. Kidney and liver damage can occur. 5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limits: 300 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; LD <sub>50</sub> = 50 to 500 g/kg 5.7 Late Toxicity: Kidney and liver damage. 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.05 ppm 5.11 IDLH Value: 10,000 ppm				

<div>6. FIRE HAZARDS</div> <div><div>6.1 Flash Point: 64°F C.C.</div><div>6.2 Flammable Limits in Air: 1.1%-6.4%</div><div>6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide</div><div>6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.</div><div>6.5 Special Hazards of Combustion Products: Not pertinent</div><div>6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.</div><div>6.7 Ignition Temperature: 886°F</div><div>6.8 Electrical Hazard: Class I, Group D</div><div>6.9 Burning Rate: 5.8 mm/min.</div><div>6.10 Adiabatic Flame Temperature: Data not available</div><div>6.11 Stoichiometric Air to Fuel Ratio: Data not available</div><div>6.12 Flame Temperature: Data not available</div></div>	<div>10. HAZARD ASSESSMENT CODE</div> <div>(See Hazard Assessment Handbook)</div> <div>A-T-U</div>																																				
<div>7. CHEMICAL REACTIVITY</div> <div><div>7.1 Reactivity With Water: No reaction</div><div>7.2 Reactivity with Common Materials: No reaction</div><div>7.3 Stability During Transport: Stable</div><div>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</div><div>7.5 Polymerization: Not pertinent</div><div>7.6 Inhibitor of Polymerization: Not pertinent</div><div>7.7 Molar Ratio (Reactant to Product): Data not available</div><div>7.8 Reactivity Group: 32</div></div>	<div>11. HAZARD CLASSIFICATIONS</div> <div><div>11.1 Code of Federal Regulations: Flammable liquid</div><div>11.2 NAS Hazard Rating for Bulk Water Transportation:<table><tr><th>Category</th><th>Rating</th></tr><tr><td>Fire.....</td><td>3</td></tr><tr><td>Health.....</td><td></td></tr><tr><td>Vapor Irritant.....</td><td>1</td></tr><tr><td>Liquid or Solid Irritant.....</td><td>1</td></tr><tr><td>Poisons.....</td><td>2</td></tr><tr><td>Water Pollution.....</td><td></td></tr><tr><td>Human Toxicity.....</td><td>1</td></tr><tr><td>Aquatic Toxicity.....</td><td>3</td></tr><tr><td>Aesthetic Effect.....</td><td>2</td></tr><tr><td>Reactivity.....</td><td></td></tr><tr><td>Other Chemicals.....</td><td>1</td></tr><tr><td>Water.....</td><td>0</td></tr><tr><td>Self Reaction.....</td><td>0</td></tr></table></div><div>11.3 NFPA Hazard Classification:<table><tr><th>Category</th><th>Classification</th></tr><tr><td>Health Hazard (Blue).....</td><td>2</td></tr><tr><td>Flammability (Red).....</td><td>3</td></tr><tr><td>Reactivity (Yellow).....</td><td>0</td></tr></table></div></div>	Category	Rating	Fire.....	3	Health.....		Vapor Irritant.....	1	Liquid or Solid Irritant.....	1	Poisons.....	2	Water Pollution.....		Human Toxicity.....	1	Aquatic Toxicity.....	3	Aesthetic Effect.....	2	Reactivity.....		Other Chemicals.....	1	Water.....	0	Self Reaction.....	0	Category	Classification	Health Hazard (Blue).....	2	Flammability (Red).....	3	Reactivity (Yellow).....	0
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Flammability (Red).....	3																																				
Reactivity (Yellow).....	0																																				
<div>8. WATER POLLUTION</div> <div><div>8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL<sub>96</sub>/fresh water</div><div>8.2 Waterfowl Toxicity: Data not available</div><div>8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor.), 8 days</div><div>8.4 Food Chain Concentration Potential: Data not available</div></div>	<div>12. PHYSICAL AND CHEMICAL PROPERTIES</div> <div><div>12.1 Physical State at 15°C and 1 atm: Liquid</div><div>12.2 Molecular Weight: 106.16</div><div>12.3 Boiling Point at 1 atm: 269.4°F = 131.8°C = 405.1°K</div><div>12.4 Freezing Point: -54.2°F = -47.9°C = 225.3°K</div><div>12.5 Critical Temperature: 650.8°F = 345.8°C = 617.0°K</div><div>12.6 Critical Pressure: 513.6 atm = 34.95 psia = 3.540 MN/m²</div><div>12.7 Specific Gravity: 0.864 at 20°C (liquid)</div><div>12.8 Liquid Surface Tension: 28.6 dynes/cm = 0.0286 N/m at 20°C</div><div>12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0364 N/m at 30°C</div><div>12.10 Vapor (Gas) Specific Gravity: Not pertinent</div><div>12.11 Ratio of Specific Heats of Vapor (Gas): 1.071</div><div>12.12 Latent Heat of Vaporization: 147 Btu/lb = 61.8 cal/g = 3.45 X 10⁴ J/kg</div><div>12.13 Heat of Combustion: -17,554 Btu/lb = -8752.4 cal/g = -406.31 X 10³ J/kg</div><div>12.14 Heat of Decomposition: Not pertinent</div><div>12.15 Heat of Solution: Not pertinent</div><div>12.16 Heat of Polymerization: Not pertinent</div><div>12.25 Heat of Fusion: 26.01 cal/g</div><div>12.26 Limiting Value: Data not available</div><div>12.27 Reid Vapor Pressure: 0.34 psia</div></div>																																				
<div>9. SHIPPING INFORMATION</div> <div><div>9.1 Grades of Purity: Research: 99.99%; Pure: 99.9%; Technical: 99.2%</div><div>9.2 Storage Temperature: Ambient</div><div>9.3 Inert Atmosphere: No requirement</div><div>9.4 Venting: Open (flame arrester) or pressure-vacuum</div></div>																																					

NOTES

## Diesel Oil (fuel oil #2)

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Physical and chemical description: flammable, slightly viscous brown liquid obtained from the distillation of crude petroleum. Diesel oil is a mixture of hydrocarbons, predominately unbranched alkanes of 10-16 carbon atoms with smaller amounts of aromatic and polynuclear aromatic hydrocarbons (PAH's). Diesel oil floats on water, having a specific gravity of less than 1.

Uses: fuel for trucks, ships, and trains.

Toxicity: Because of their water solubility and carcinogenicity, benzene and PAH's are the chemicals of health concern in diesel oil. Benzene, found in trace amounts in diesel oil, is known to cause leukemia, a cancer of the blood forming cells. PAH's as a class (1-10% in diesel) are considered to be carcinogenic to a number of animal species. Benzo(a)pyrene is one of the most commonly found and carcinogenic PAH. The alkanes of 10-16 carbon atoms, which make up the bulk of diesel oil, are of less concern due to their very low water solubility and low toxicity.

Concentration Guidelines and Standards: The maximum tolerable concentration for diesel oil in drinking water is 100 ug/l, due to organoleptic (taste and smell) considerations. The EPA Office of Drinking Water recommends that the short term concentrations of PAH's in drinking water not exceed 25 ug/l. This is the 7 day suggested no adverse response level (SNARL) and does not take into account the long term cancer risk. These concentrations should be tolerated only in emergency situations where no other higher quality water source is available.

## Naphthalene (C<sub>10</sub>H<sub>8</sub>)

Physical and Chemical Description: white crystalline solid with a characteristic "moth ball" odor. Naphthalene is more dense than water (sp. gr. 1.145) and has a solubility of 30,000 - 40,000 ug/l @ 25°C. It melts at 80°C but will sublime (volatilize from a solid) at room temperature. Naphthalene is considered a polynuclear aromatic hydrocarbon (PAH).

Uses: intermediate in dye production and formation of solvents, lubricants, and motor fuels. Used directly as a moth repellant.

Toxicity: Naphthalene may be absorbed by inhalation, ingestion or skin or eye contact. Chronic exposure can cause cataracts, kidney disease and red blood cell breakdown, especially in infants and individuals deficient in the enzyme G6PD. Naphthalene has been shown to be nonmutagenic and noncarcinogenic.

Classification: Hazardous Substance (EPA)

Hazardous Waste (EPA)

Priority Toxic Pollutant (EPA)

Persistence: Naphthalene can oxidize in the presence of light and air, 50% after 14 days in one study. Microbial degradation has also been demonstrated in the laboratory in solutions as concentrated as 3.3 ug/l. Little breakdown is expected, however, under the dark, anaerobic conditions characteristic of in-situ ground water.

Phenanthrene (C<sub>14</sub>H<sub>10</sub>)

Physical and Chemical Description: colorless, monoclinic crystals soluble in water, 1,000-1,300 ug/l @ 2.5°C, specific gravity = 1.179.

Phenanthrene is a PAH.

Uses: dyes, explosives, a natural constituent of coal tar and of diesel oil (0.35%).

Toxicity: Phenanthrene has been identified as a mild allergen and human dermal photosensitizer. Limited acute and chronic animal experiments show it to be of low to moderate toxicity.

Classification: none

Fluorene (C<sub>13</sub>H<sub>10</sub>)

Physical and Chemical Description: Combustible white solid having a density of 1.20 and a water solubility of 1980 ug/l.

Uses: Manufacture of dyestuffs.

Toxicity: Little specific information is available about the toxicity of fluorene but it is a polynuclear aromatic hydrocarbon (PAH), a group which contains known human carcinogens.

Classification: None

## 5.0 SITE CONTROL

5.1 ZONATION. The general zonation protocols that should be employed at hazardous waste sites are described in Chapter 8.0 of the CLEAN HASP. The site-specific zonation that will be used for this project is described as follows. The site is not classified as a hazardous waste site and, therefore, no zonation procedures will be used during this project. However, whenever possible, non-intrusive procedures such as paperwork, equipment preparation, etc., will be conducted away from the site.

5.2 COMMUNICATIONS. When radio communication is not used, the following air horn signals will be employed:

HELP	three short blasts	( . . . )
EVACUATION	three long blasts	( _ _ _ )
ALL CLEAR	alternating long and short blasts	( _ . _ . )

5.3 WORK PRACTICES. General work practices to be used during ABB-ES projects are described in Chapter 9.0 of the CLEAN HASP. Work at the site will be conducted according to these established protocol and guidelines for the safety and health of all involved. Specific work practices necessary for this project or those that are of significant concern are described as follows.

- Work and sampling will be conducted in Level D clothing and equipment.

## 6.0 DECONTAMINATION AND DISPOSAL

All personnel and/or equipment leaving contaminated areas of the site will be subject to decontamination, which will take place in the contamination reduction zone. General decontamination practices used during ABB-ES projects are described in Chapter 13.0 of the CLEAN HASP.

6.1 PERSONNEL DECONTAMINATION. The site is not classified as a Hazardous Waste Site, therefore, stringent decontamination practices are not warranted.

6.1.1 Small Equipment Decontamination Small equipment will be protected from contamination as much as possible by keeping the equipment covered when at the site and placing the equipment on plastic sheeting, not the ground. Sampling equipment used at the site will be used only once or will be field cleaned between samples with soapy water (Alconox), rinsed with clean water, rinsed with an approved Quality Assurance/Quality Control solvent, and final rinsed with organic free water.

6.1.2 Heavy Equipment Decontamination No heavy equipment is planned to be used during this project.

6.2 COLLECTION AND DISPOSAL OF DECONTAMINATION PRODUCTS. All disposable protective gear, decontamination fluids (for both personnel and equipment), and other disposable materials will be disposed of at the site. Decontamination fluids (i.e., methylhydrate [e.g., split spoons and groundwater sampling pump]) will be stored in amber glass bottles. Disposable materials (e.g., gloves and Tyveks<sup>TM</sup>) will be bagged and disposed of properly.

## 7.0 EMERGENCY AND CONTINGENCY PLAN

This section identifies emergency and contingency planning that has been undertaken for operations at this site. Most sections of the HASP provide information that would be used under emergency conditions. General emergency planning information is addressed in Chapter 14.0 of the CLEAN HASP. The following subsections present site-specific emergency and contingency planning information.

7.1 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATIONS. The site HSO or the Health and Safety designee is the primary authority for directing operations at the site under emergency conditions. All communications both on- and off-site will be directed through the HSO or designee.

7.2 EVACUATION. Evacuation procedures at the site will follow those procedures discussed in Chapter 14.5 of the CLEAN HASP for upwind withdrawal, site evacuation, and evacuation of the surrounding area. Evacuation from the DFSP facility will be conducted with all personnel meeting at the main facility gate at the northwest corner of the site. Evacuation will proceed by travelling south (left) on North Rhett Boulevard, away from the site.

7.3 EMERGENCY MEDICAL TREATMENT AND FIRST AID. Any personnel injured on-site will be rendered first aid as appropriate and transported to competent medical facilities for further examination and/or treatment. The preferred method of transport would be through professional emergency transportation means; however, when this is not readily available or would result in excessive delay, other transport will be authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

## 8.0 ADMINISTRATION

8.1 PERSONNEL AUTHORIZED DOWNRANGE. Personnel authorized to participate in downrange activities at this site have been reviewed and certified for site operations by the Project Manager and the HSS. Certification involves the completion of appropriate training, a medical examination, and a review of this site-specific HASP. All persons entering the site must use the buddy system, and check in with the Site Manager and/or HSO before going downrange.

### CERTIFIED ABB ENVIRONMENTAL TEAM PERSONNEL:


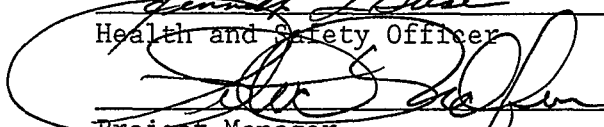
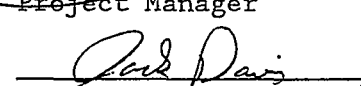
<u>*+ Ken Busen</u>	<u>*+ Joe Daniels</u>
<u>*+ Peter Redfern</u>	<u>*+ Andrew Harvey</u>
<u>*+ Jay Koch</u>	<u>*+ Kathleen O'Neil</u>
<u>*+ Alan Stodghill</u>	<u>*+ Peggy Layne</u>
<u>*+ Kevin Warner</u>	

### OTHER CERTIFIED PERSONNEL:


\* FIRST-AID-TRAINED  
+ CPR-TRAINED



8.2 HEALTH AND SAFETY PLAN (HASP) APPROVALS. By their signatures, the undersigned certify that this HASP will be used for the protection of the health and safety of all persons entering this site.

 _____ Health and Safety Officer	<u>4/24/91</u> _____ Date
 _____ Project Manager	<u>4/26/91</u> _____ Date
 _____ Health and Safety Manager/Supervisor	<u>4/26/91</u> _____ Date

8.3 FIELD TEAM REVIEW. I have read and reviewed the health and safety information in the HASP. I understand the information and will comply with the requirements of the HASP.

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

SITE/PROJECT: \_\_\_\_\_

8.4 MEDICAL DATA SHEET. This Medical Data Sheet will be completed by all on-site personnel and kept in the Support Zone during site operations. It is not a substitute for the Medical Surveillance Program requirements consistent with the CLEAN HASP. This data sheet will accompany any personnel when medical assistance or transport to hospital facilities is required. If more space is required, use the back of this sheet.

Project: \_\_\_\_\_

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Home Telephone: Area Code (\_\_\_\_) \_\_\_\_\_

Age: \_\_\_\_\_ Height: \_\_\_\_\_ Weight: \_\_\_\_\_

In case of emergency, contact: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: Area Code (\_\_\_\_) \_\_\_\_\_

Do you wear contact lenses? Yes ( ) No ( )

Allergies: \_\_\_\_\_

List medication(s) taken regularly: \_\_\_\_\_

Particular sensitivities: \_\_\_\_\_

Previous/current medical conditions or exposures to hazardous chemicals:

\_\_\_\_\_

Name of Personal Physician: \_\_\_\_\_

Telephone: Area Code (\_\_\_\_) \_\_\_\_\_

#### 8.5 EMERGENCY TELEPHONE NUMBERS.

Police Department	(803) 747-5711
Primary Hospital (U.S. Naval Hospital)	(803) 743-5130
Alternate Hospital (Baker Hospital)	(803) 744-2110
Base Fire Department	(803) 744-4073
Off-site Emergency Services	(803) 744-4073
Poison Control Center	(800) 962-1253
National Response Center	(800) 424-8802
Regional USEPA Emergency Response	(800) 414-8802
Site HSO: <u>Alan Stodghill</u>	(904) 656-1293
General Site Supervisor: <u>Ken Busen</u>	(904) 656-1293
Project Manager: <u>Peter Redfern</u>	(904) 656-1293
ABB Environmental HSM: <u>C.E. Sundquist</u>	(207) 775-5401 x101

8.6 ROUTES TO EMERGENCY MEDICAL FACILITIES. The primary source of medical assistance for the site is:

U.S. Naval Hospital  
Charleston, South Carolina

DIRECTIONS TO PRIMARY: Take Rhett Ave. (Hwy 136) south to Park Circle. Turn right and drive around Circle until you reach Montague Ave. Go west on Montague Ave. until you reach Interstate 26. Take Interstate 26 south approximately 3.5 miles. Hospital is on the right side of the Interstate. See Figure 8-1.

The alternate source of medical assistance for the site is:

Baker Hospital  
Charleston, South Carolina

DIRECTIONS TO ALTERNATE: Take Rhett Ave. (Hwy. 136) south to Park Circle. Turn right and drive around circle until you reach Durant Ave. Go west on Durant Ave. until you reach Rivers Ave. Take Rivers Ave. south approximately 1.5 miles. Hospital is on the left side of Rivers Ave. See Figure 8-1.

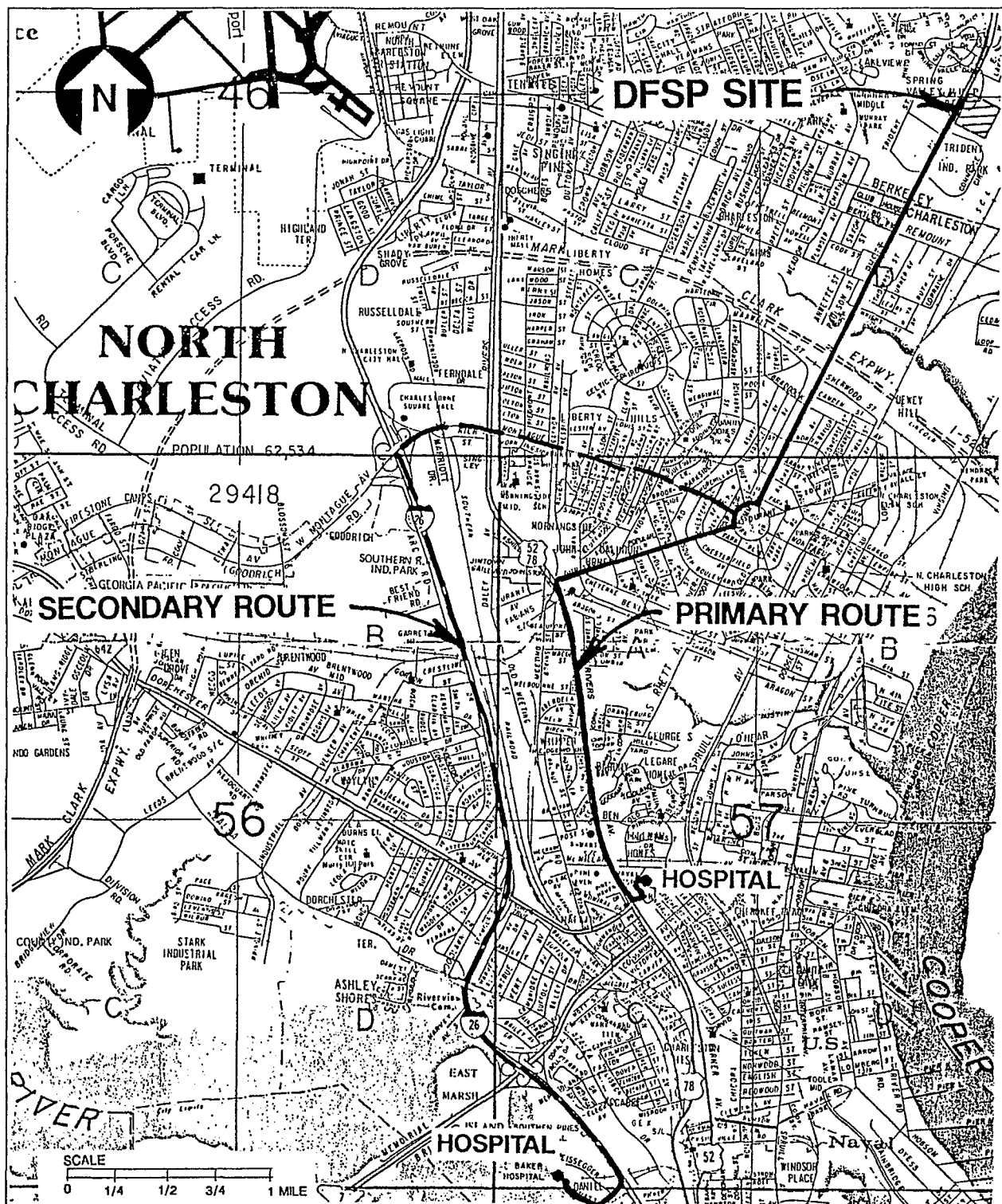


FIGURE 8-1

ROUTE TO U.S. NAVAL HOSPITAL  
AND BAKER HOSPITAL



SITE SPECIFIC  
HEALTH AND SAFETY PLAN

DEFENSE FUEL SUPPLY POINT  
HANAHAN, SOUTH CAROLINA

## JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

### Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm or employees. Employers must comply with occupational safety and health standards issued under the Act.

### Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

### Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

### Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides the employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discrimination.

### Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

### Proposed Penalty

The Act provides for mandatory penalties against employers of up to \$1,000 for each serious violation and for optional penalties of up to \$1,000 for each nonserious violation. Penalties of up to \$1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

### Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for health such as training.

### Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State labor or Health department or a State university.

### POSTING INSTRUCTIONS

Employees in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

### More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia	(404) 347-3573
Boston, Massachusetts	(617) 565-7164
Chicago, Illinois	(312) 353-2220
Dallas, Texas	(214) 767-4731
Denver, Colorado	(303) 844-3061
Kansas City, Missouri	(816) 426-5861
New York, New York	(212) 337-2325
Philadelphia, Pennsylvania	(215) 596-1201
San Francisco, California	(415) 995-5672
Seattle, Washington	(206) 442-5930

Washington, D.C.  
1989 (Revised)  
OSHA 2203

Elizabeth Dole, Secretary of Labor  
**U.S. Department of Labor**  
Occupational Safety and Health Administration

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or a facsimile) in a conspicuous place where notices to employees are customarily posted.



ABB Environmental Services, Inc.  
2571 Executive Center Circle East  
Suite 100  
Tallahassee, FL 32301-5001